VOL. XIX. No. 4 APRIL 1934

MECCANO MAGAZINE

A MODEL OF THE FAMOUS VICTORY
(see page 266)

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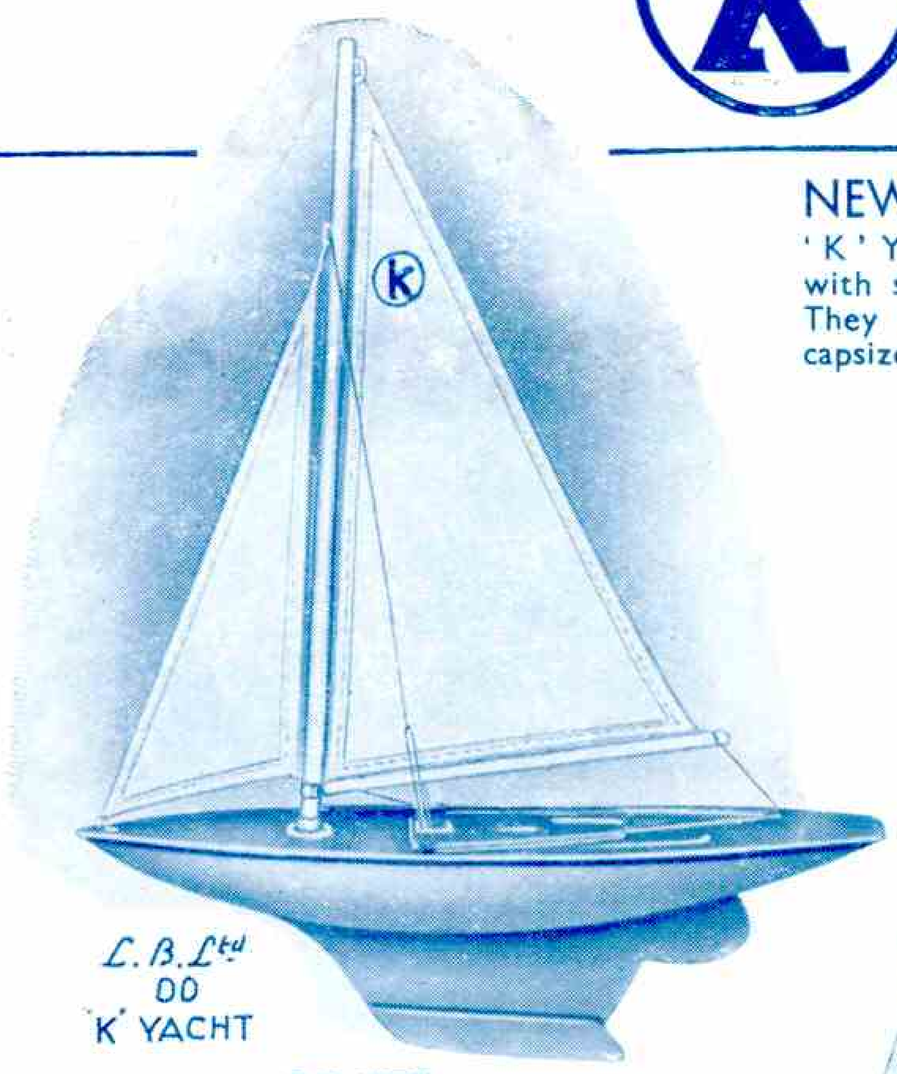

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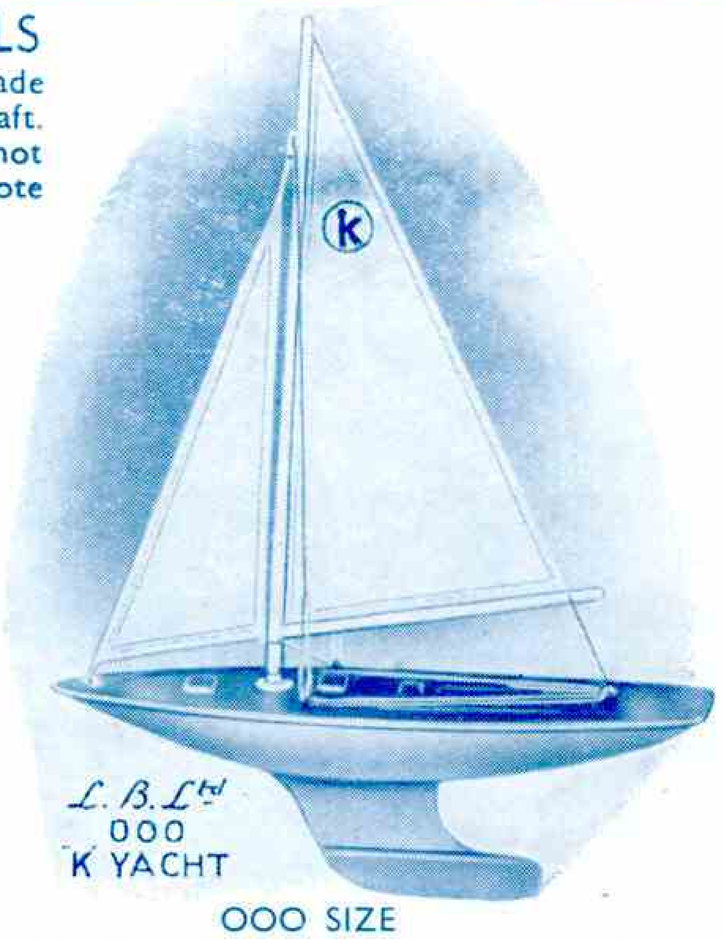

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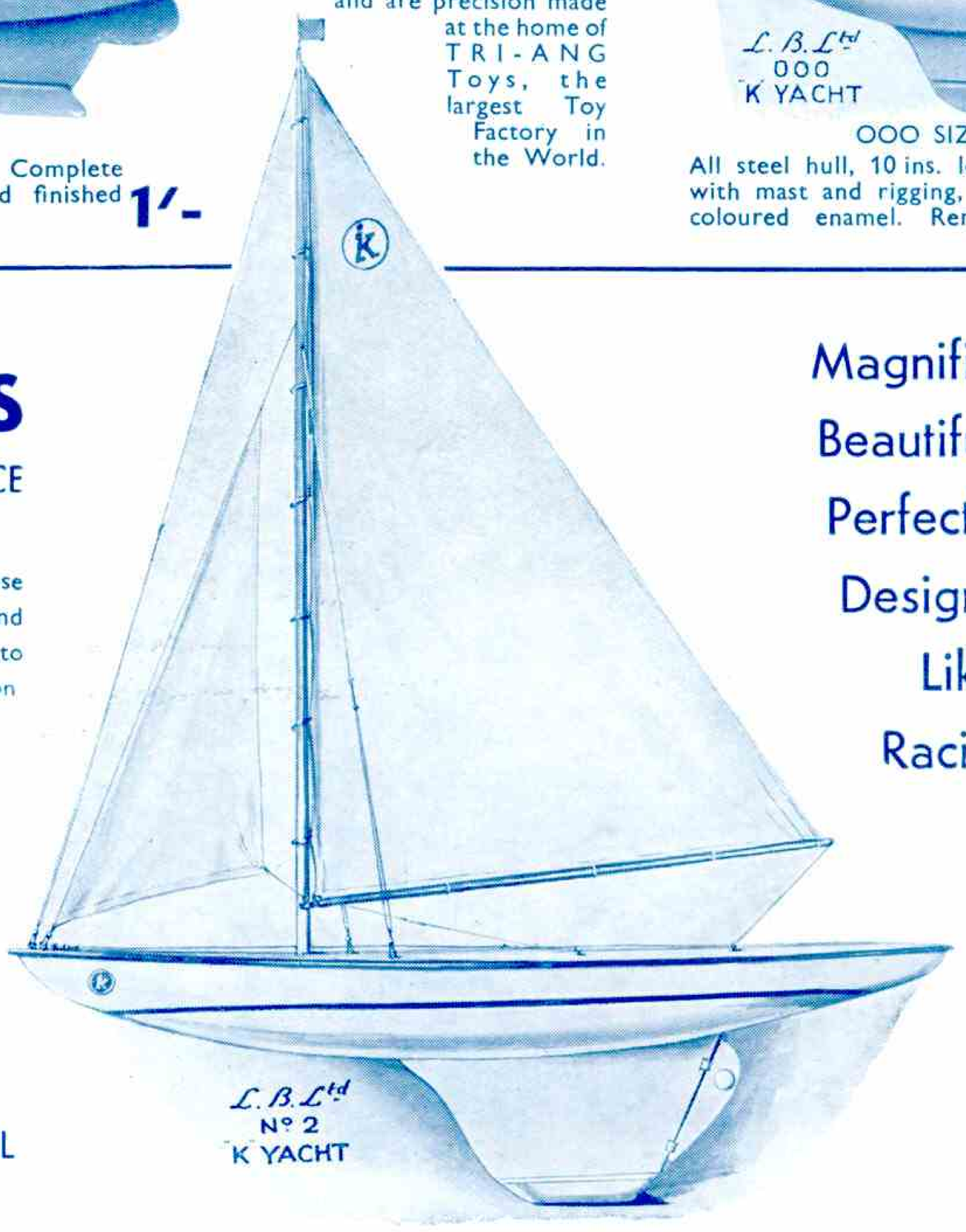

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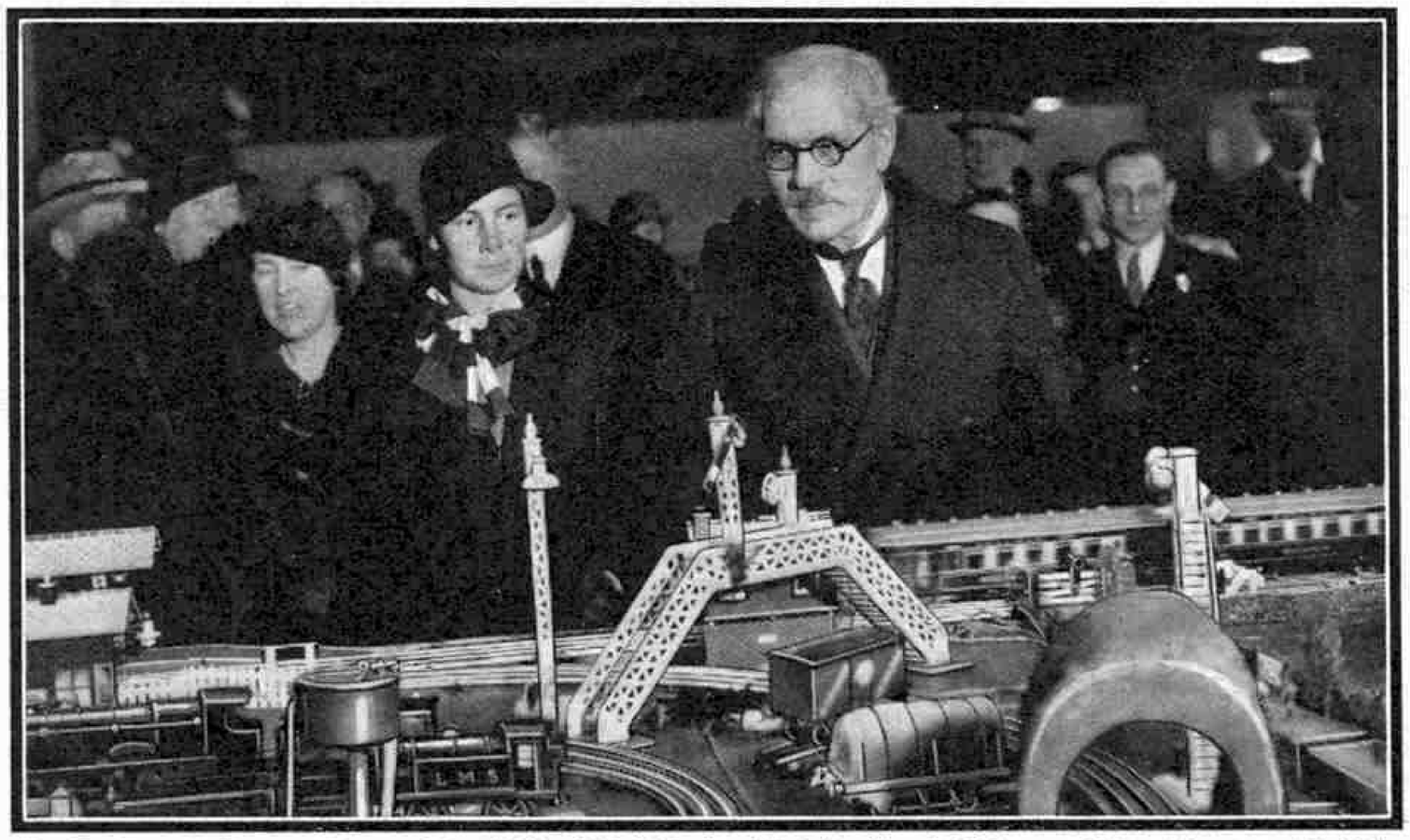
April, 1934

With the Editor

Premier's Interest in Hornby Trains

The interesting photograph reproduced on this page shows the Rt. Hon. J. Ramsay Macdonald, the Prime Minister, watching with eager interest operations on the Hornby Train layout at the Stand of Meccano Limited at the recent British Industries Fair. Mr. Macdonald was delighted with the layout and expressed the wish that it could be transferred to the House of Commons. A display of the capabilities of Hornby Trains there would certainly have been attractive to every member, and especially to those who have associations with railway work. The Rt. Hon. J. H. Thomas, Secretary for the Dominions, would have appreciated the realism of the miniature railway and no doubt would have derived as much pleasure from operation of the switches, which control the electric train seen in our photograph, as he did from driving real locomotives when he was actively engaged in railway work.



The Rt. Hon. J. Ramsay Macdonald and Miss Ishbel Macdonald at the Stand of Meccano Ltd. at the recent British Industries Fair. The Prime Minister was keenly interested in the operation by remote control of a Pullman Train, hauled by Hornby No. 2 Special Electric Locomotive, "Yorkshire."

This year's Fair was an even greater success than those of previous years and provided another triumph for Meccano and Hornby Trains. Throughout the period during which the Fair was open the Stand of Meccano Limited was thronged with buyers from all parts of the world, all of whom were greatly attracted by the range of busy working models and the extensive Hornby Train layout that was continually in operation. The Meccano models displayed included a large Workshop that was a hive of industry; a splendid Water Mill; a realistic representation of a four-oared crew, the members of which maintained a rapid stroke for hours at a time without tiring; and many other models that revealed both the attractive appearance of Meccano structures and the ease with which real engineering mechanisms were reproduced. Miniature reproductions of the "*Flying Scotsman*" and other famous engines, operated by remote control, ran over the electrified track of the Hornby Train display in a manner that was a source of never-ending attraction to every visitor. This will be readily understood from the accompanying photograph showing a small portion of the extensive track, which was fully equipped with stations, signals and signal cabins, switches and other accessories that play their part in making every Hornby Railway system a real railway in miniature.

A record number of buyers and other visitors from overseas attended the Fair and displayed the greatest interest in the exhibits in all sections. Reports show that more business was done than in any previous year. This is good news, for it means that there are greatly improved prospects of employment during 1934.

Ten Years' Progress in Air Transport

Readers who are familiar with the giant aeroplanes of Imperial Airways, either from inspection of the machines themselves or from the many illustrations of them that have appeared in the "*M.M.*," will find it difficult to believe that it is only 10 years this month since the first regular service of the company was established between London and Paris. There had previously been air transport companies, and a certain number of air routes had been provided with what would now be regarded as skeleton services; but the aeroplane as a means of travel only began to achieve popularity on the formation of Imperial Airways, which has recently celebrated its 10th birthday.

In 1924 the routes over which the machines of Imperial Airways flew had a total length of only 1,760 miles; to-day regular services are in operation over 14,000 miles of airways between Great Britain and more than 20 other countries. Every day hundreds of passengers pass through Croydon Aerodrome, the famous London airport, and the wonderful advance made by air transport during the last few years is shown by the fact that on occasions travel between England and the Continent is only possible by air, for rough weather in the Channel sometimes interrupts or seriously delays communication by water.

The aeroplanes themselves also illustrate the progress that flying has made since the Imperial Airways services began. The machines of the Handley Page W8B and W10 types first employed were fitted with twin engines and carried about eight passengers, but they soon proved too small to cope with the growing demand for accommodation, and were succeeded by the triple-engined Armstrong Whitworth "Argosies." Even these giant machines proved inadequate when the Empire air routes to India and South Africa were opened, and to-day these routes are operated chiefly by means of the Handley Page "Hannibals" carrying 18 passengers, and "Heracles" carrying 38 passengers. Another type developed for use on Empire airways is the Armstrong Whitworth "Atalanta," a four-engined high-wing monoplane carrying 17 passengers, that has been specially designed for flying between Cairo and Capetown; and a new four-engined biplane, designed and built by the De Havilland Aircraft Co. Ltd., has recently completed its official Air Ministry flying trials. The new machine has a speed of more than 170 m.p.h., and is intended for use between Singapore and Cootamundra, in New South Wales, when the service of Imperial Airways is extended to Australia.

Story of H.M.S. "*Victory*"

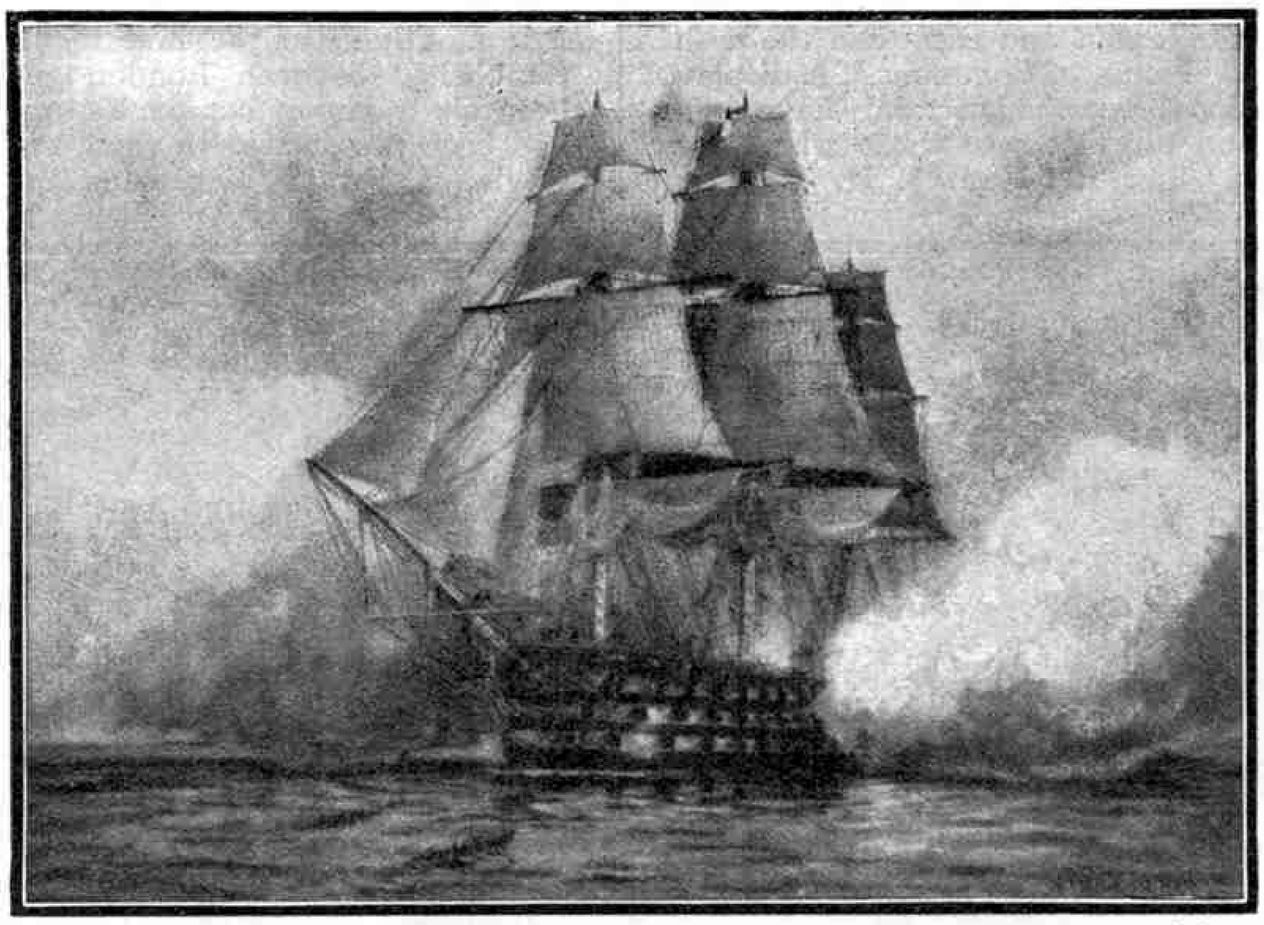
Britain's Most Famous Ship

THE most famous ship in British naval history is the "*Victory*," Nelson's flagship at the Battle of Trafalgar. The battle is described in the article on Nelson on page 267, and here we tell briefly the story of this wonderful old vessel.

The "*Victory*" was designed in 1759 by Thomas, afterwards Sir Thomas, Slade, senior surveyor to the Navy, and her keel was laid at Chatham Dockyard on 23rd July that year. She took six years to build, and was launched on 7th May, 1765. At that stage her masts had not been erected, and for the purpose of the launching ceremony three tall flagstaffs were used, the foremost staff to fly the Admiralty flag, the second to carry the Royal Standard, and the third to fly the Union Jack. Immediately after the ceremony the "*Victory*" was towed to a fitting-out-berth. When completed she had a net tonnage of 2,162, and had cost over £100,000.

This famous ship is what is known as a "three-decker," that is, three of her decks are designed to mount guns. When first equipped she had 30 guns mounted on each of the three upper decks and an additional 10 on the top deck, a total of 100 guns but this number was altered slightly at various times during her career. She is 226 ft. 6 in. long from figure-head to taffrail, and is 52 ft. across at the widest part.

At the time when the "*Victory*" was completed this country was at peace with her neighbours, and for 13 years the ship lay at her moorings at Chatham. In 1778 war with France became imminent, and Vice-Admiral Keppel, on being appointed commander of the Channel Fleet, chose the "*Victory*" as his flagship. She was sent to Portsmouth, where Keppel went on board, and he put to sea with a fleet totalling 30 ships. He encountered a French fleet of 32 ships of the line off Ushant on 27th July and a slight engagement took place. This was the first naval conflict in which the "*Victory*" participated.



The "Victory," Nelson's flagship, engaging an enemy. This photograph is reproduced from the Editor's "Book of the Warship," by courtesy of the publishers, G. G. Harrap and Co. Ltd.

The most famous of the naval engagements in which the "*Victory*" took part was the battle of Trafalgar in 1805, when she was Nelson's flagship. He was killed during the battle, and subsequently the ship conveyed his body to this country. From 1806 to 1809 she was the flagship of Sir James Saumarez, and on 8th April, 1809, she took part in his blockade of Russian ships at Cronstadt. The "*Victory's*" last commission was in April 1812, when she was one of a squadron of 11 ships under Saumarez that was sent to the Baltic. In October of that year she was recalled, and returned to Portsmouth where her crew was paid off. In 1825 she was made flagship to the Admiralty Commander-in-Chief at Portsmouth, and was used in this capacity until 1869. Since that date she has been retained as a souvenir of the great battle of Trafalgar.

In spite of her sturdy construction the "*Victory*" eventually began to show signs of decay, and in 1922 the Society for Nautical Research appointed a Technical Committee to superintend her restoration to her condition as at Trafalgar, and opened a fund to cover the cost of the work. The nature of the work necessitated drydocking the ship, and she was transferred from the harbour to an adjacent drydock which, it is claimed, is the oldest in the world. The subsequent examination of her hull below the waterline showed that the repairs made necessary by her long service afloat were much more extensive than had been anticipated. The work was put in hand, however, and the preservation of the ship and her permanent support in the dock is now assured for at least a century to come.

The structural restoration of the ship was completed by the summer of 1928, and on 17th July of that year the King inspected the work that had been carried out. After chatting for a time with those on the quarter deck, the King ascended the poop and viewed the quarters once occupied by Admiral Nelson and Captain Hardy. He then proceeded from deck to deck. The tour lasted nearly an hour, and at its conclusion the King unveiled a simple tablet of oak and ivory to commemorate the completion of the work.

Another interesting ceremony took place on the "*Victory*" on Trafalgar day of the same year, when the wooden knee against which Lord Nelson was supported in the hour of his death was replaced in its original position in the cockpit. This knee was taken out of the ship in 1903 after a collision between her and H.M.S. "*Neptune.*" It was accepted by King Edward VII and was preserved at Windsor for a time, but eventually the King gave it to the British Sailors' Society, who treasured it for the sake of its donor as well as for its historic value. In view of the restoration of the "*Victory,*" however, the Society decided that the right place for the knee was in the ship itself, and with the King's approval they sent it to Portsmouth in charge of a detachment of boys from the Prince of Wales's Hostel. The boys were received on the quarter deck of the "*Victory,*" and after an address by Admiral Sir Osmond Brock, Commander-in-Chief at Portsmouth, the knee was carried by sailors to the cockpit and placed on the spot from which it had been removed 25 years previously.

About five or six years ago a few Naval officers conceived the idea of helping "Navy Week" by creating an actual sailing model of the "*Victory.*" They obtained from the Admiralty the loan of an obsolete 42 ft. motor launch that had been stripped of its machinery and was on the Admiralty "Sale list." On this hull the bulwarks, etc., were built up, model guns mounted so as to protrude through the gunports, masts and yards erected, and rigging and sails added, the whole representing as nearly as possible the original "*Victory.*" During "Navy Week" the likeness between the model and its prototype is increased by the presence on board the former of a crew dressed in the seamen's uniform of the Nelson period, consisting of black and white striped jerseys and white duck trousers. The crew are Naval officers who generously give their spare time to sailing the ship.

Our cover illustration this month shows this remarkable model on the occasion of her visiting Swanage. She was towed into the bay by an Admiralty trawler, and then released. The crew on board the miniature "*Victory*" then set all sail to a light steady breeze, and cruised up and down the bay. The model presented a picturesque appearance to the onlookers ashore. When viewed from this distance her size was deceptive, but when one of the crew appeared on the poop deck his height indicated the scale of the model. The seaworthiness of the vessel has been further demonstrated by the fact that on several occasions she has sailed along the south coast to Weymouth. The model is brought into use during "Navy Week" each year, and always proves a great attraction.

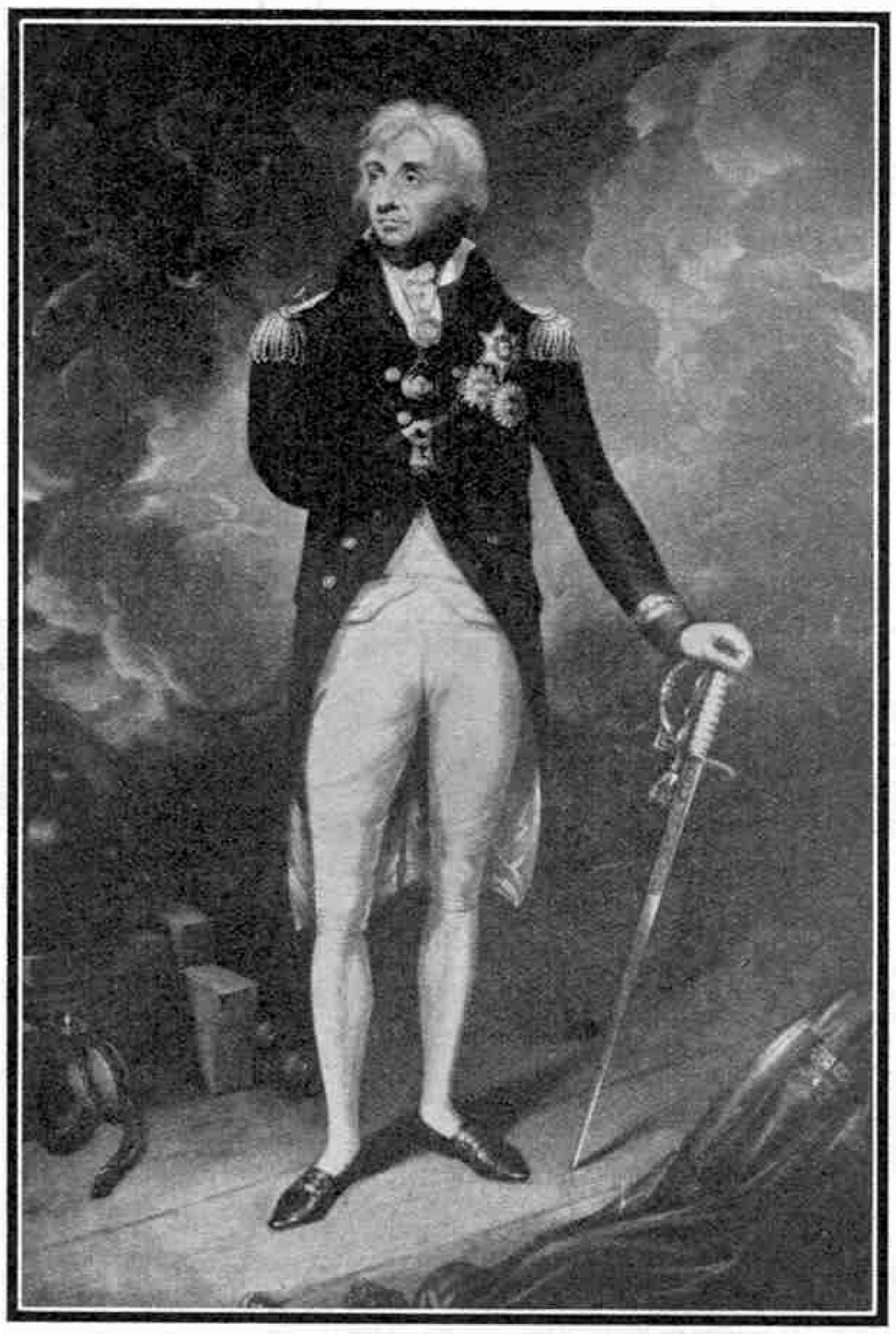
XI.—LORD NELSON

HORATIO NELSON, the most famous of British Admirals, was born on 29th September, 1758, at Burnham Thorpe, Norfolk, where his father was the rector of the parish. As the boy grew up he developed a bold spirit and love of adventure, and at an early age he longed to go to sea. After the death of Nelson's mother in 1770 an uncle, Captain Maurice Suckling, undertook to provide for one of the 11 children of the family, but he was surprised when he heard that Horatio was to be sent to him, as the lad was delicate. According to Mahan, in his "*Life of Nelson*," Suckling replied: "What has poor little Horatio done that he, being so weak, should be sent to rough it at sea? But let him come, and if a cannon-ball takes off his head he will at least be provided for."

Nelson was only 12 years old when he began his naval career as a ship's boy on Suckling's vessel "*Raisonnable.*" Shortly afterwards Suckling was transferred to another ship, and he moved Nelson to an outward bound West India merchantman so that he could learn navigation. The lad stood up well to the hardships and miseries of a sailor's life in those days, and retained his love of adventure. At the close of this voyage to the tropics he joined the "*Carcass*," one of two vessels that sailed in the Spring of 1773 to explore the Arctic waters.

When the expedition returned to England Nelson transferred to the "*Sea-horse*," of 20 guns, one of the ships of a squadron commanded by Sir Edward Hughes that was sent to the East Indies. While serving in this ship he was made a midshipman. The tropical climate proved too much for him and he was invalided home, but he soon recovered. On 9th April, 1777, he passed the examination for promotion to a lieutenancy, and was appointed second lieutenant of the "*Lowestoft*," a frigate commanded by Captain Locker. In this ship he visited Jamaica. Ill-health compelled Locker to return to England, and Nelson was transferred to the "*Bristol*," the flagship of Sir Peter Parker, Commander-in-Chief of the Jamaica station, and was promoted to lieutenant. Further advancement soon followed, first to the command of the "*Badge*," a brig, and in June 1779 to the captaincy of the "*Hinchinbrook*," a frigate of 24 guns. While in command of this ship Nelson took part in an expedition up the San Juan River to capture a Spanish fort at the head of Lake Nicaragua. The fort was won, but the climate caused many casualties from sickness among the English seamen and troops. Nelson again became ill and he was sent home.

From 1782 until 1787, except for a short visit to England in 1784, Nelson served in the West Indies. These years of active service were followed by five years at home; but a life of leisure did not appeal to Nelson, and when the newly-formed French Republic declared war against England and Holland on 1st February, 1793, he immediately applied for active service. He was given command of the "*Agamemnon*," of 64 guns, the first ship of the line commanded by him. The "*Agamemnon*" was one of a fleet of 15 ships under Admiral Hood, which were ordered to the Mediterranean. Hood arrived off Toulon late in May, and blockaded the French port until it surrendered three months later. Shortly afterwards Napoleon recaptured it, however, and forced the English fleet to withdraw. Hood then captured Corsica so as to have a convenient base from which to renew the blockade of Toulon, and during the attack on the island Nelson was blinded in the left eye by a splinter of stone from a wall struck by a cannon-ball.

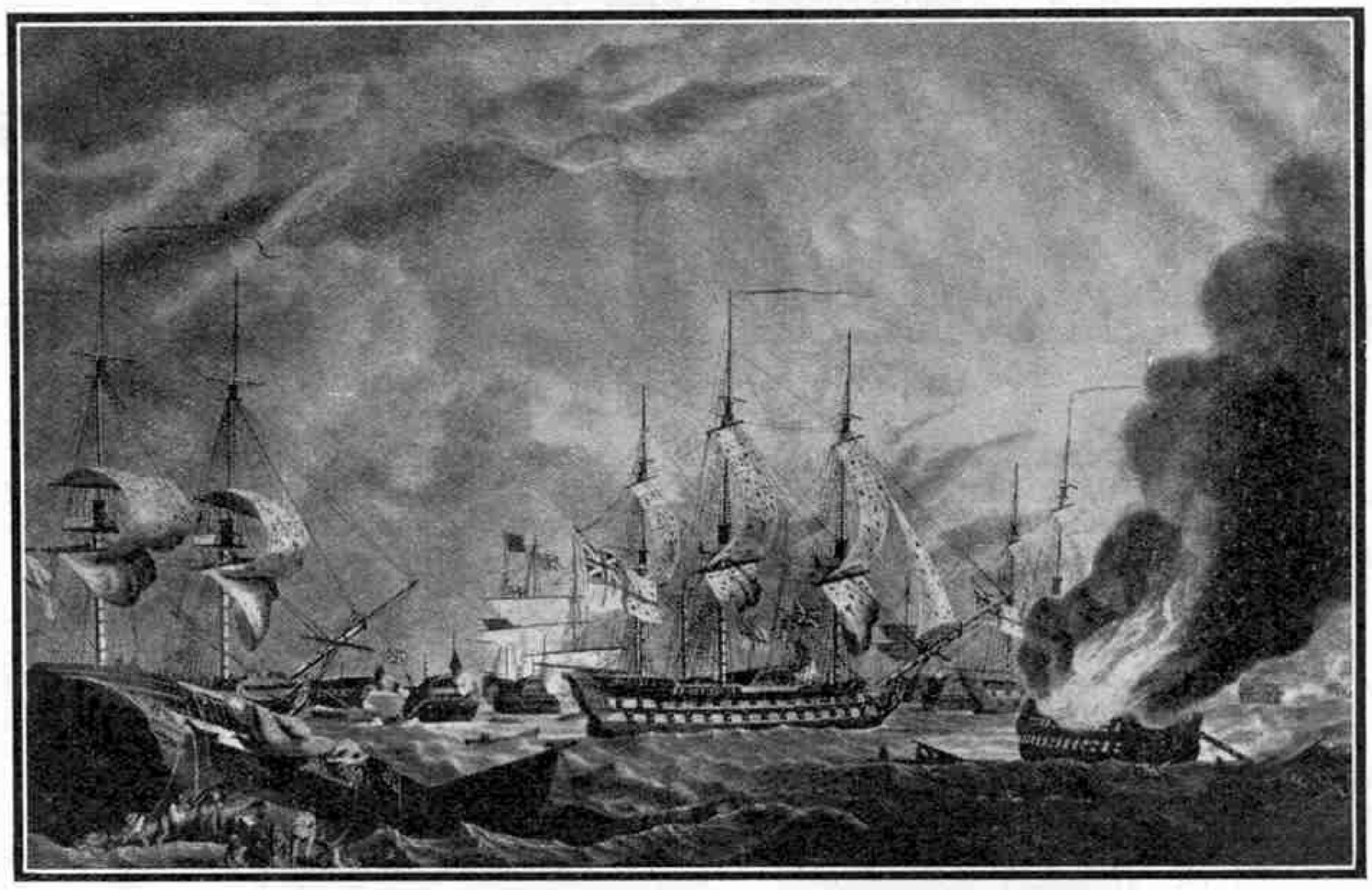


Admiral Lord Nelson. The illustrations to this article are from prints in the possession of T. H. Parker Ltd., 28, Berkeley Square, London, by whose courtesy we are enabled to reproduce them.

Subsequently Hood retired on account of ill-health, and he was succeeded by Hotham, whose failure to keep a close watch on Toulon enabled the French fleet there to escape early in March 1795. The fleet was sighted at sea on 9th March and a long pursuit began. On the 13th one of the French ships, the "*Ca Ira*," was involved in a collision and lagged behind. Nelson overtook and disabled her, but she was rescued and taken in tow by the "*Censeur*," another French ship. Next day the English fleet drew close enough to engage the enemy, and a general action developed during which Nelson forced the "*Ca Ira*" and her consort to surrender; but Hotham did not continue the fight to a decisive finish. Later in the year he was succeeded by Admiral Jervis, the subject of the previous article in this series. Readers of that article will remember that the alliance of Spain with France in October 1796 rendered the Mediterranean untenable to the English, and that Jervis entrusted to Nelson the task of transferring the garrison and stores from Corsica to Elba, and later from Elba to Gibraltar.

On the way back to Gibraltar during the second of these missions, in January 1797, Nelson paused before Cartagena and saw that the Spanish fleet had left; and at Gibraltar he found that Jervis also had put to sea. Nelson hastened out into the Atlantic, greatly hoping that he would be in time for the impending battle between the two fleets. He was pursued for a long time by two Spanish ships of the line, and was almost captured. During the night of 11th February, 1797, Nelson overtook a fleet that he recognised as an enemy. Fortunately a mist prevented his ship from being identified, and he conformed with the movements of the enemy fleet during many hours of the night, until satisfied that it was the Spanish fleet heading for Cadiz. He then discreetly dropped out. One can readily believe that when he met Jervis off Cape St. Vincent on the 13th, his pleasure at arriving before the Spanish Fleet was as great as that of his commander at finding Nelson safe and unharmed.

The two fleets met next day. In our article on Admiral Jervis we described the thrilling battle that took place, and how Nelson, disobeying orders, broke away from the English line and successfully prevented the van of the Spanish fleet from escaping. At one stage of the battle, Nelson, in the "*Captain*," was engaged simultaneously with the Spanish ship "*San Josef*" of 112 guns, the "*San Nicolas*" of 80 guns, and two or three smaller ships. The concentrated firing of all these vessels severely damaged his ship, but Captain Collingwood, in the "*Excellent*," came to his aid and silenced the guns of the two Spanish ships of the line. Shortly afterwards the two ships fouled each other. Nelson then succeeded in boarding the "*San Nicolas*," and using her as a gangway he led his men across her deck and on to the "*San Josef*" where, to quote his own words, "the Spanish captain, with a bow, presented me his sword, and said the Admiral was dying of his wounds below. I asked him, on his honour, if the ship were surrendered; he declared she was, on which I gave him my hand and desired him to call to his officers and ship's company, and tell them of it—which he did." The battle ended in a victory for Jervis that caused great rejoicing in England. He was raised to the peerage with the title of Earl of St. Vincent, and Nelson received a knighthood and was promoted to Rear Admiral.



The scene of destruction on the morning after the Battle of the Nile, 1st August, 1798.

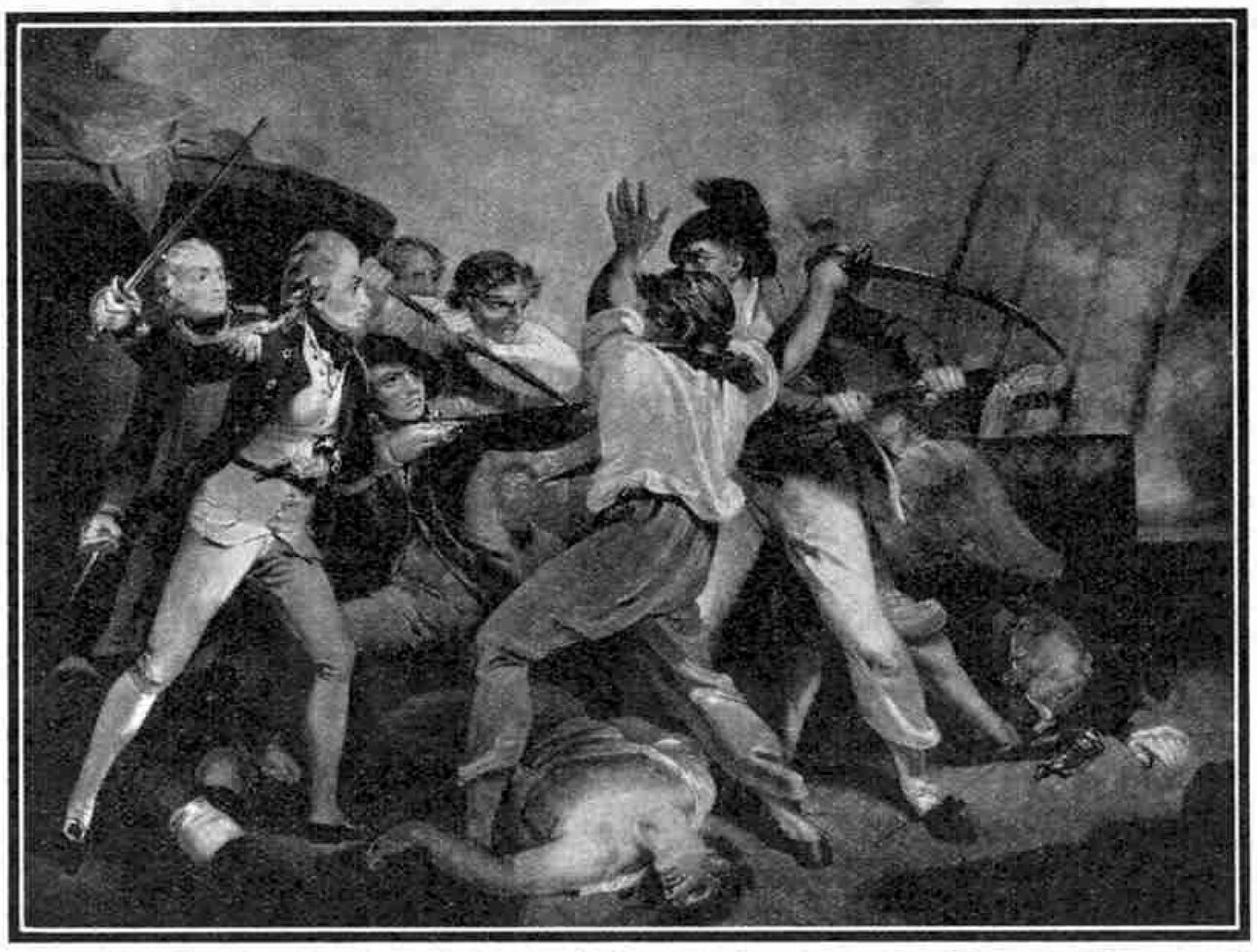
Jervis refitted his damaged ships at Lagos Bay and then blockaded Cadiz where the remnants of the Spanish fleet had taken refuge, but they refused to come out and renew the battle. In July that year he gave Nelson command of an expedition to capture some Spanish treasure ships known to be at Santa Cruz, Teneriffe. Nelson made the attack at night but failed, and he was wounded so severely in the right arm that it had to be amputated. He was granted sick leave and returned to England, after an absence of over four years. The wound was slow in healing and he did not return to active service until April 1798, when he rejoined Jervis, who was still keeping a look-out off Cadiz.

It became known that the French were equipping a powerful fleet at Toulon, and on 8th May Jervis sent a squadron, under Nelson in the "*Vanguard*," of 74 guns, to investigate. Nelson ascertained that the harbour contained a fleet totalling 40 ships of the line, frigates and smaller vessels, and 200 transports ready to embark an army under Napoleon. He despatched a sloop to Jervis with this exciting information, and continued his watch on the port. On 20th May a storm dismasted his flagship and scattered his frigates, and before he was able to resume the lookout the French fleet and transports put out to sea. The fleet was commanded by Admiral Brueys, and totalled 17 ships, of which 13 were ships of the line.

On 7th June Nelson was joined by Troubridge, who brought reinforcements from Jervis that increased the number of English ships of the line to the same total as the French. Nelson sought the enemy at Naples and Alexandria in vain, but if he had remained at the latter port his search would soon have ended, as Brueys arrived there two days after Nelson had departed, and the troops disembarked. It was not until 1st August that the French fleet was sighted, anchored in a long curved line near the shore of Aboukir Bay, 15 miles from Alexandria. The ships were in a deep water channel and were protected on the seaward side by an extensive shoal in the bay and on the landward side by shore batteries. The enemy were first observed about 1 o'clock and by the time the English fleet had drawn near to them it was late afternoon, but in spite of this fact Nelson was determined to bring about an immediate battle. When the beginning of the French line was reached the leading five British ships advanced on the landward side, and the next five ships, headed by the "*Vanguard*" and including the "*Bellerophon*," moved forward on the seaward side. The first five French ships were soon hemmed in and raked on both sides by a heavy fire, and eventually they surrendered.

Nelson was wounded in the forehead early in the engagement and was carried below, where he refused to be attended to before his turn came. Fortunately the wound was not very serious, and when it had been dressed he returned to the deck.

The "*Culloden*," commanded by Troubridge, was unlucky enough to run aground on the shoal, and two other English ships, the "*Alexander*" and the "*Swiftsure*," which had been sent to reconnoitre Alexandria, did not reach the scene of the battle until after dark. They at once hastened to the aid of the "*Bellerophon*," as she was getting the worst of a close engagement with the French flagship "*L'Orient*," a huge three-decker of 120 guns. About 9 o'clock "*L'Orient*" caught fire, and an hour later she blew up with a terrific roar, only 70 of her crew being saved. The battle ended about 3 a.m., by which time 11 of the French ships of the line had been taken, sunk or wrecked; the other two escaped. No English ship was lost, but many bore the scars of the battle, and the "*Bellerophon*" was dismasted.



Nelson boarding the Spanish ship "San Nicolas" during the Battle of Cape St. Vincent, 14th February, 1797.

The great victory brought Nelson new honours, and he was made Baron Nelson of the Nile and awarded a pension of £2,000 a year. He also received a grant of £10,000 from the East India Company. He did not return to England until two years later, and in the meantime he blockaded Malta and there captured the two French ships that had escaped at the Battle of the Nile.

On 1st January, 1801, Nelson was promoted to Vice Admiral of the Blue, and later in the year he served as second in command to Admiral Parker in the campaign against the "Armed Neutrality," an alliance of Denmark, Russia, Sweden and Prussia formed to prevent Great Britain from infringing their rights on the high seas.

Parker gave the Danes an opportunity to withdraw from the alliance, but they refused, and urged on by Nelson, he then prepared to attack Copenhagen. The city was defended at the northern end by a powerful shore battery, known as the Trekroner battery, a long line of old hulks moored near the shore, floating batteries, and a small squadron of ships. Nelson recommended an immediate attack by way of the southern or weaker defences. Parker agreed, and entrusted the attack to him, and gave him 12 ships and all the frigates and sloops for the purpose. While Nelson moved toward the southern end of the defences Parker endeavoured to divert the attention of the enemy by a feint at the northern end.

The plan did not work as well as Nelson expected. Three of his ships grounded on a large shoal, and an adverse wind made it difficult for Parker's ships to approach the northern defences. The Danes fought so vigorously that eventually Parker signalled to Nelson to withdraw, at the same time sending him a private message to use his discretion in regard to the signal. Nelson decided to continue the fight, and then occurred the famous incident of the "blind eye." When the signal was hoisted Nelson placed his telescope to his blind eye and said to his captain: "I really do not see the signal." In view of the fact that he had already received Parker's private message this remark could not have been meant otherwise than as a jest. Late in the afternoon he called upon the Danes to surrender, and this they did; and on 9th April a 14 weeks Armistice was signed.

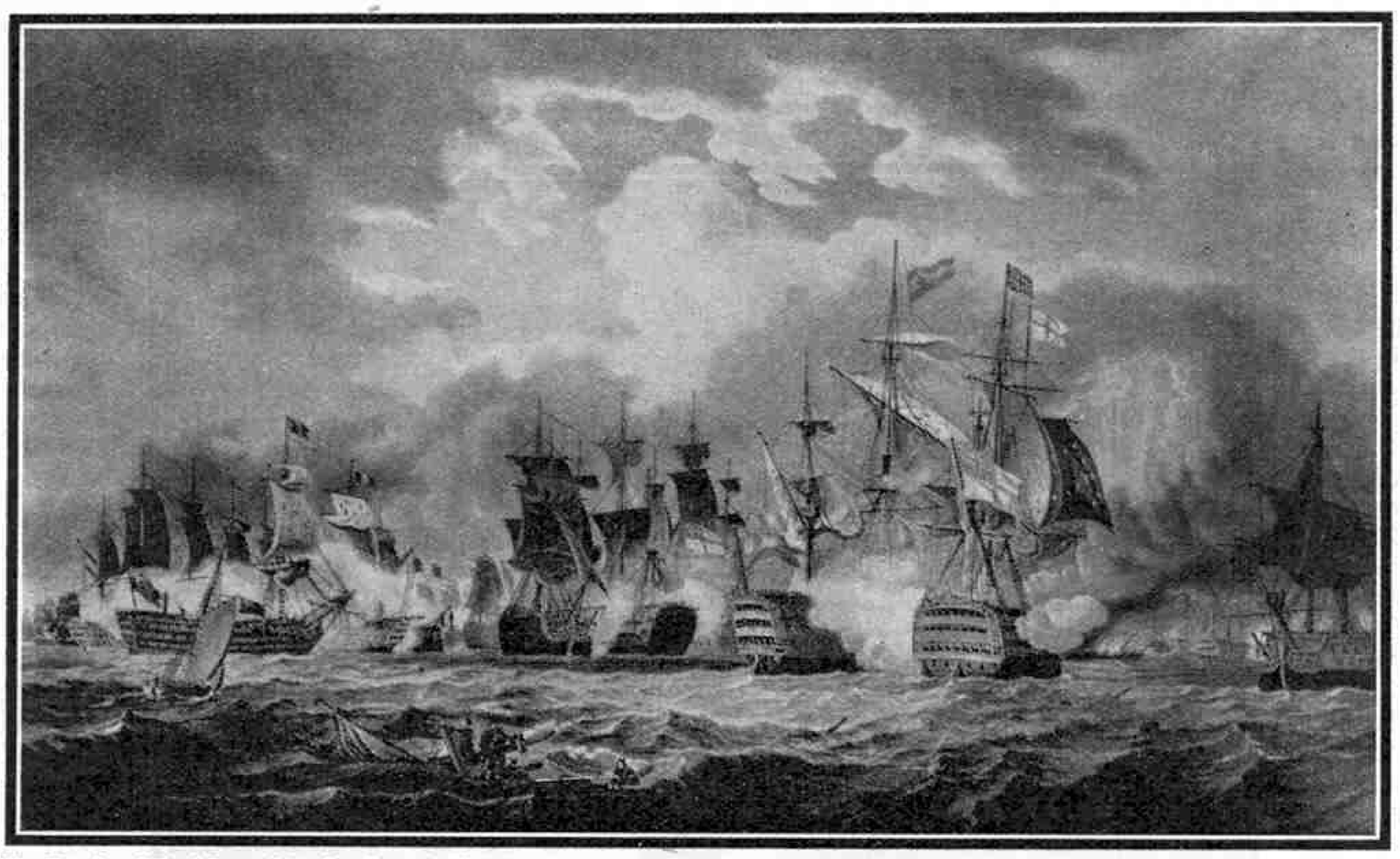
Hostilities between England and France ceased in 1802, but broke out again in the next year, when England also declared war against Spain. An extensive blockade of enemy ports was begun to prevent the French and Spanish fleets from joining forces, and squadrons were sent to Brest, Cadiz and Ferrol. Nelson was appointed to the command of the Mediterranean fleet and was sent to Toulon, which he blockaded for 18 months. During this long, tedious duty he kept the crews of his ships fit and ready for immediate battle.

The blockade might have lasted longer if Admiral Treville, commander of the French fleet at Toulon, had not died. He was succeeded by Villeneuve, who had been captain of one of the French ships at the Battle of the Nile. Villeneuve succeeded where Treville had failed, as early in 1805 he gave Nelson the slip and got the French fleet away from Toulon. He was driven back by bad weather, but in the meantime his departure had been discovered and Nelson had sailed for Alexandria, wrongly believing this to be the destination of the enemy. Villeneuve set out again from Toulon on 30th March, and after being joined by seven other ships —one French and six Spanish—he sailed for the West Indies, and reached Martinique about the middle of May.

Nelson eventually picked up the trail and hastened after the elusive foe, reaching Barbadoes early in June. Villeneuve had been instructed to remain 40 days at Martinique to give a French squadron from Brest time to join him. While waiting for them he captured some British merchantmen, and their crews told him that Nelson had arrived at Barbadoes with 19 ships of the line. Villeneuve had no desire to meet his pursuers, and he hurriedly recrossed the Atlantic. He was intercepted off Brest by a squadron under Rear Admiral Calder, but after a brief engagement, during which he lost two Spanish ships, he managed to escape, and reached Ferrol on 22nd July. Nelson heard of the enemy's flight and he was soon after them, but again he wrongly guessed their destination, this time assuming it to be Toulon. Off Brest he met Calder, who told him of the engagement off Brest.

Nelson returned home on leave, but three weeks after coming ashore he was sent for by the Admiralty, who had received word from Admiral Collingwood that Villeneuve had anchored at Cadiz after an unsuccessful attempt to join the French squadron still at Brest. Nelson re-embarked in the "*Victory*," and with 11 other ships under his command sailed from Portsmouth on 15th September to join Collingwood.

The two squadrons met off Cadiz on 28th September, and Nelson was warmly welcomed by Collingwood and his men. There was no sign of the enemy coming out to fight, but eventually they were ordered to do so by Napoleon, and on 21st October the Franco-Spanish fleet was sighted off Cape Trafalgar, sailing in a south-easterly direction. It was commanded by Villeneuve and totalled 33 ships, which were strung out in a long line. The British fleet, totalling 27 ships of the line, was about 10 miles west of the enemy, and sailing east. It was in two columns, one of 12 ships led by Nelson in the "*Victory*" and the other led by Collingwood in the "*Royal Sovereign*." As the fleets drew nearer the French reversed and headed back toward Cadiz. Shortly before the battle began Nelson signalled his famous message to his fleet: "England expects that every man will do his duty."



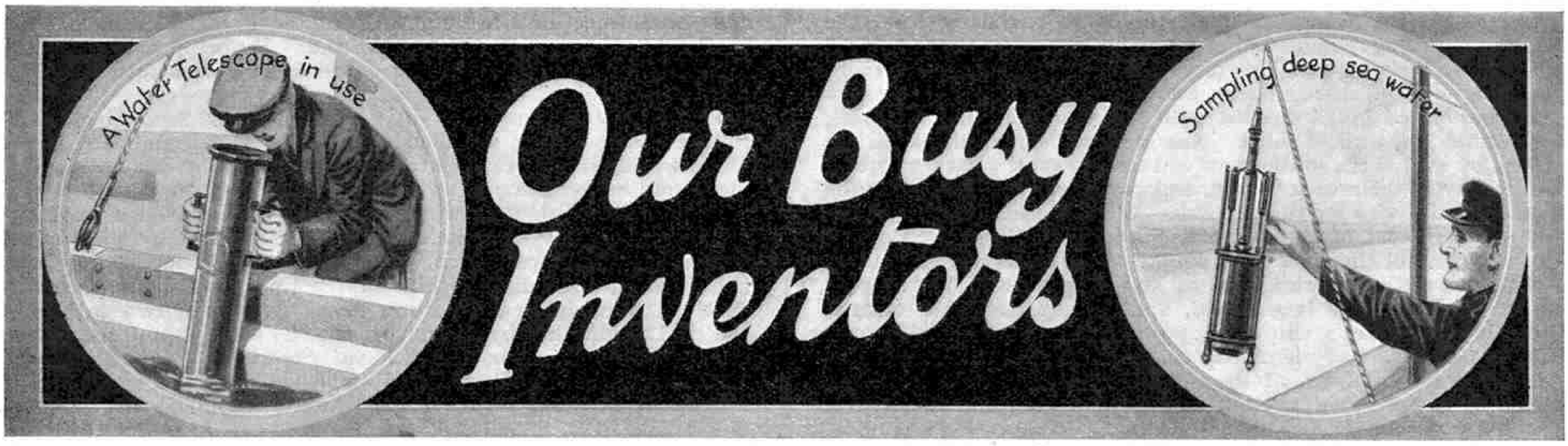
The Battle of Trafalgar, 21st October, 1805. On the left is the "Royal Sovereign," flagship of Admiral Collingwood, with only her foremast standing, and in the centre is the "Victory," Nelson's famous flagship, engaging the Spanish "Santissima Trinidad," a fine four-deck ship carrying 130 guns.

The enemy fired the first shot, and Collingwood was the first on the English side to reply. He led his column towards the centre of their line, and closed with the Spanish flagship "*Santa Ana*," of 112 guns. Nelson and his line headed for the van of the enemy fleet, and on reaching it the "*Victory*" passed under the stern of Villeneuve's flagship "*Bucentaure*," and delivered a heavy broadside that killed or wounded nearly 400 of the crew and dismounted 20 of her guns.

A great fight developed between the "*Victory*" and the "*Redoubtable*," and it had been in progress only a short time when a musketeer, firing from the mizzentop of the French ship, struck down Nelson as he walked with Captain Hardy on the "*Victory's*" quarter deck. As Nelson was picked up he said to the captain: "They have done for me at last, Hardy." "I hope not," replied the captain. "Yes, my backbone is shot through," said Nelson. He was carried down into the dimly-lit cockpit, where in great pain he grew weaker as the hours passed. The battle continued, and it was a long time before Hardy was able to leave his post on deck and hasten below to tell his dying commander how the fight was progressing. By then about 12 enemy ships had been taken, and an hour later he was able to give Nelson the cheering news that a victory had been achieved and a total of 14 or 15 ships captured. Nelson passed away shortly after Hardy's second visit.

The defeat of the enemy was severe, and only nine French and six Spanish ships were saved. Only four of the 18 ships captured by the English ever reached Gibraltar, however, as 11 of them were wrecked during a great storm on the 23rd, and three were recaptured by the enemy. No English ship was lost. The battle of Trafalgar ended Napoleon's hope of shattering the British Navy by a combined French and Spanish attack, and freed the people of this country from their fear of an invasion by the French.

The news of the victory reached London on 6th November, but the rejoicing it inspired was dimmed by the grief at the death of Nelson. His body was brought in the "*Victory*" to Spithead, and lay in state in the Painted Hall at Greenwich for three days before the State funeral at St. Paul's Cathedral on 6th January, 1806. A monument to him was erected in the Cathedral, but a much more familiar memorial is the great Nelson Column, 185 ft. high, that stands in Trafalgar Square, London. Another fine memorial to Nelson is his flagship "*Victory*," still at Portsmouth, and this fine old ship is the subject of a special article on page 266.



By P. A. Tent

IN the issue of the *"M.M."* for December, 1933, I referred to a suggestion, made by Sir William C. Dampier, F.R.S., that bankers and financiers should work out a scheme for financing approved inventions in their early days and before they are ready for public appeal. A similar suggestion was made by Mr. A. H. Gledhill during a recent discussion on invention arranged by the Institution of Mechanical Engineers. Mr. Gledhill remarked that success in world competition involves the rapid and effective translation of invention into action, and argued that it would pay to set aside a sum of money every year for the encouragement of inventive talent, and for the specialised education of inventive youths. He suggested that the Patent Office itself could provide ample funds for this purpose, for in 1932-33 this institution made a net profit of £146,000.

The revolving brush kerb painter at work. Whitening kerbs with its aid makes them more readily visible at night and in fogs. For our photograph we are indebted to Serviceable Patents Ltd.

In the past, inventors too often have been left to plough their own ways through the intricacies of law and commerce. They are not usually good business men, and many waste their time on devices and processes for which no practical application is possible. The Institute of Patentees now assists inventors in many valuable ways and has made a special feature of issuing lists of wanted inventions. More remains to be done to give the inventor his rightful position, however, and to ensure that no useful invention is lost to the world through lack of funds, or of the technical knowledge required to make it a complete success.

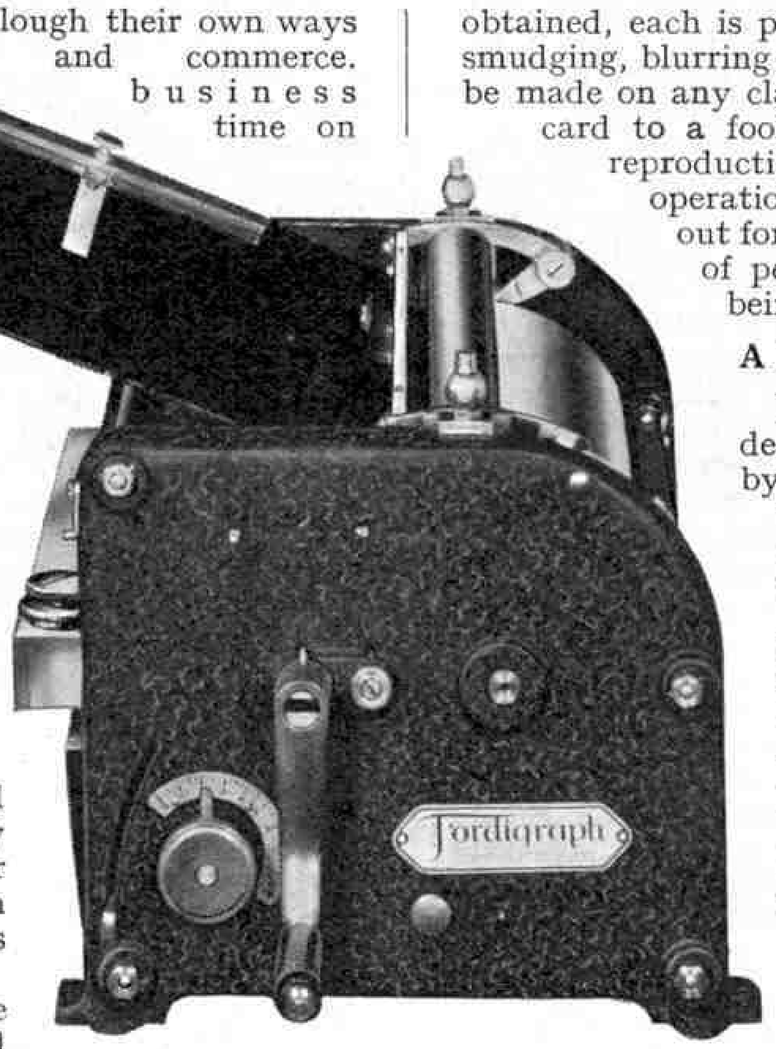
A New Rotary Reproducing Machine

The lower illustration on this page shows a new machine that enables facsimile reproductions of typed or written letters to be obtained rapidly and easily. I saw this at work recently and was greatly impressed by the remarkably simple manner in which it is operated and also by the high quality of the reproductions, which are as sharp as if they were printed.

When a typewritten circular is to be reproduced on this machine, the original is typed on a sheet of paper of appropriate size behind which is placed a specially-prepared sheet of carbon paper, with the coated face in contact with the paper above it. On separating the sheets, the words are seen in reverse on the back of the upper sheet of paper, having been printed there by the ink from the carbon paper. No further preparation is necessary, for the sheet thus prepared is the original from which the copies are made. It is placed round the large roller of the Fordigraph and one after another blank sheets of paper are fed into the machine, to be pressed in turn against the original and to have the circular printed upon them.

The ink on the original is moistened by means of special fluid to enable it to be transferred to the copies. The moistening is automatic, the fluid being fed in the minute quantity required for each operation by means of a felt pad into which it rises by capillary action.

In spite of the speed with which the copies are obtained, each is perfectly dry on issuing from the machine, and smudging, blurring and creasing is impossible. Reproductions can be made on any class of paper and on sizes varying from a small card to a foolscap sheet, and a further advantage is that reproductions in several colours can be produced in a single operation. The originals can be filed away and brought out for use after long periods of time, the total number of perfect copies obtainable from a single original being some hundreds.



The Fordigraph, by means of which facsimile reproductions of written, typed or drawn originals can be obtained at the rate of 40 per minute. Photograph by courtesy of Frank R. Ford Ltd., Birmingham.

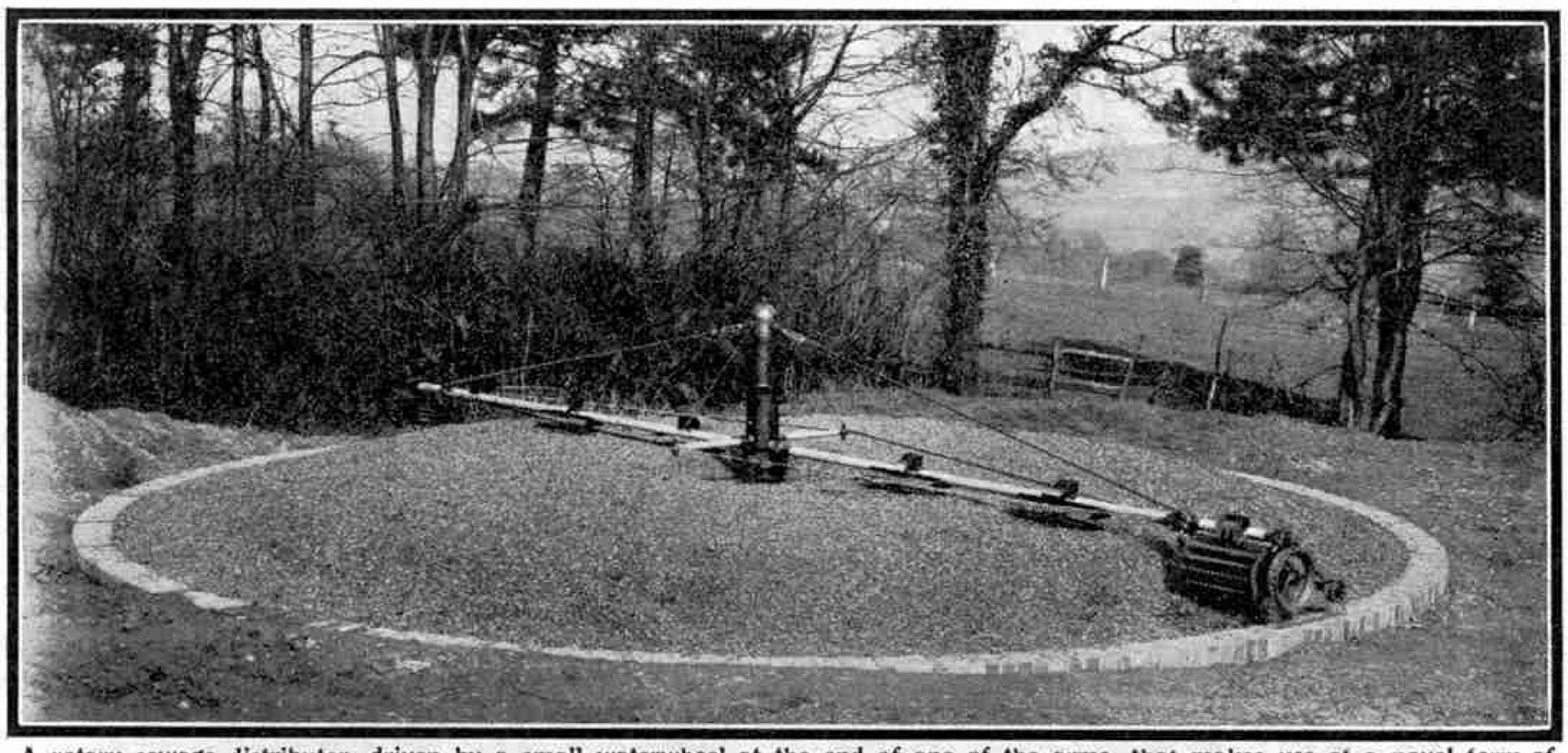
A New Type of Traffic Light Signal

I heard recently of a useful device that has been designed to meet the difficulty, often experienced by road users, of gauging the time that remains before the light of a traffic signal changes in colour. It is a new form of signal in which each of the main lights has round it a circle of 12 small lamps of its own colour. These are equally spaced, like the figures of a clock, and when the main light itself is illuminated they are lit up in turn at regular intervals, thus showing the progress of the period during which the traffic light of the same colour is visible.

This simple addition to traffic signals should help considerably in ensuring their correct observance. For instance, it should be of value in preventing motorists from speeding over busy crossings at the last available moment, for a glance at the circle of small green lights surrounding the main light will show exactly how much time remains before the change of colour is due to take place. The use of amber lights as a warning is not completely

satisfactory, for with them there is a slight element of uncertainty in this respect, and so long as this remains certain motorists will persist in trying to "beat the lights."

I wonder how many of my readers know that island refuges for pedestrians crossing crowded or wide thoroughfares were invented as long ago as 1860 by John Hastings, a Liverpool saddler. Road dangers apparently were a problem even at that time, long before motor cars were thought of, and no doubt the unhappy foot passenger who was not quick enough to leap out of the way of a horse-drawn omnibus was branded as a "jay walker," or given some equally contemptuous name! Hastings was greatly impressed by the danger of crossing the junction of two busy streets in the centre of Liverpool, where his shop was situated, and he suggested that the provision of a small island site, lit with a gas lamp, would provide an excellent refuge for pedestrians. Little notice was taken of the suggestion until a well-known Liverpool stationer was knocked down and fatally injured. Then six island refuges were constructed at various danger points in Liverpool, and these proved so successful, not only as refuges for foot passengers, but also as guides for keeping the swiftly moving traffic in orderly streams, that others were built in the city, and the system shortly became almost universal in busy centres.



A rotary sewage distributor, driven by a small waterwheel at the end of one of the arms, that makes use of a novel form of creeper track. The photographs on this page are reproduced by the courtesy of Jones and Atwood Ltd.

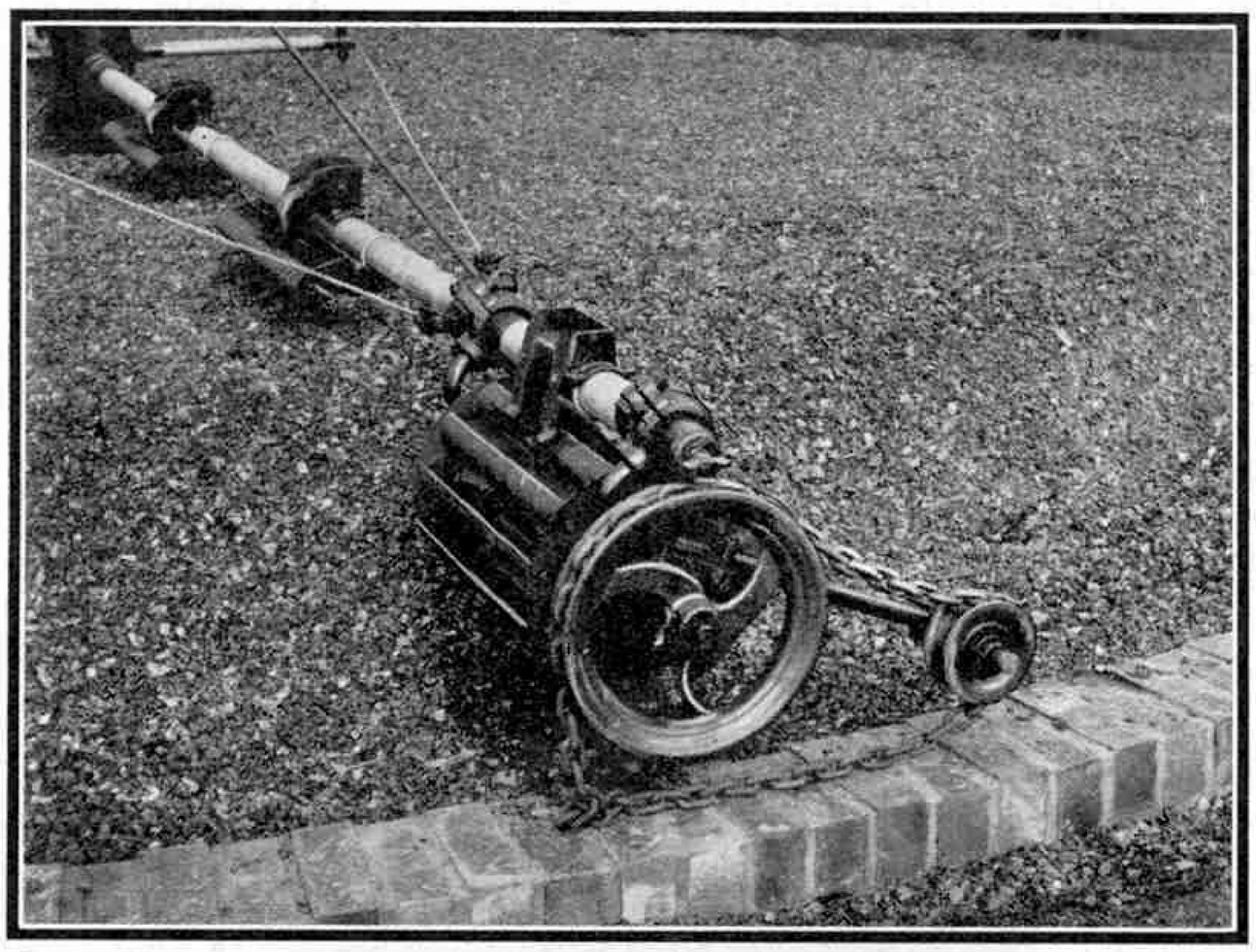
Painting 20 Miles of Kerbstone a Day

The problem of safety on our roads will only be solved by a combination of devices, each contributing its share in dealing with special kinds of danger; and one useful means of reducing the number of accidents was the subject of an invention seen at the Public Works, Roads and Transport Exhibition, held last November. This is a machine for painting kerbs white in order to make them more readily visible at night and in fog. This kerb painter is shown in action in one of the accompanying illustrations. A mixture of lime and water is carried in a small tank in which is a mechanically-operated stirrer to prevent the lime from settling. The white liquid is fed through tubes to two brushes, one of which is horizontal and paints the top of the kerb, while the other is vertical and disc-shaped, and spreads the mixture on the side. The brushes rotate in the opposite direction to that in which the machine travels. The top brush can be adjusted to paint kerbs from 2 in. to 8 in. in width, and the side brush automatically adjusts itself to any height of kerb up to 8 in.

The machine can be pushed by hand, as in our illustration, and then a speed of three miles per hour can easily be kept up. For work on a larger scale it can be towed by a vehicle carrying a large tank to accommodate the main supply of lime, and in a test carried out on this plan 20 miles of kerb were painted in one day.

Another interesting device shown at this Exhibition made use of a novel and ingenious form of creeper track in which the moving part is a loose chain. It was part of a rotating sewage distributor, and is illustrated on this page. The distributor itself consists of long arms suspended from a central column, and sewage is fed into the filter bed beneath through orifices placed at intervals along the arms that discharge it on to spreaders. The driving mechanism is at the end of one of the arms, the other carrying a balancing weight at its outer end; and the drive comes from the sewage itself, for part of this is discharged through a weir at the end of one of the arms on to the vanes of a brass waterwheel of the overshot type. The endless chain of the creeper track passes over a sprocket wheel attached to the waterwheel and round a smaller wheel, and the weight of the loose portion hanging from the two wheels gives sufficient grip on the surface to cause the arm as a whole to travel forward.

In the accompanying illustrations the mechanism is shown at work on the smooth level track of the retaining wall of a sewage bed, but it acts just as efficiently on the rough surface of the filter, which is made of slag, clinker or broken stone. It seems to me that many applications could be found for this simple type of creeper track.



Close-up view of the waterwheel that drives the distributor shown in the upper photograph on this page. The loose driving chain acts as a creeper track.

Electric Lamp Inventions

When studying the products of inventors I am often surprised to find what far-reaching effects follow tiny changes in design. An excellent instance of this is a device introduced by Phillip's Lamps Ltd., to enable lamps to be used in inverted positions, or at any desired angle, as readily as in an ordinary holder. It seems that in an ordinary lamp the wire supports are so shaped that in the inverted position the filament resting on them is in contact with a double portion. Part of the filament is then short circuited, and therefore does not become so hot as the rest, with the result that unequal heating shortens its useful career.

In the new lamp the difficulty is remedied by coiling the supporting wire tightly, so that the filament makes only a single point of contact, no matter in what position the lamp may be placed. Although such a change in the design of a lamp may appear a small matter, it necessitates the designing of new machines in order to produce large quantities in an uninterrupted flow, which is the great requirement of manufacturing operations in these days when prices must be reduced as far as possible.

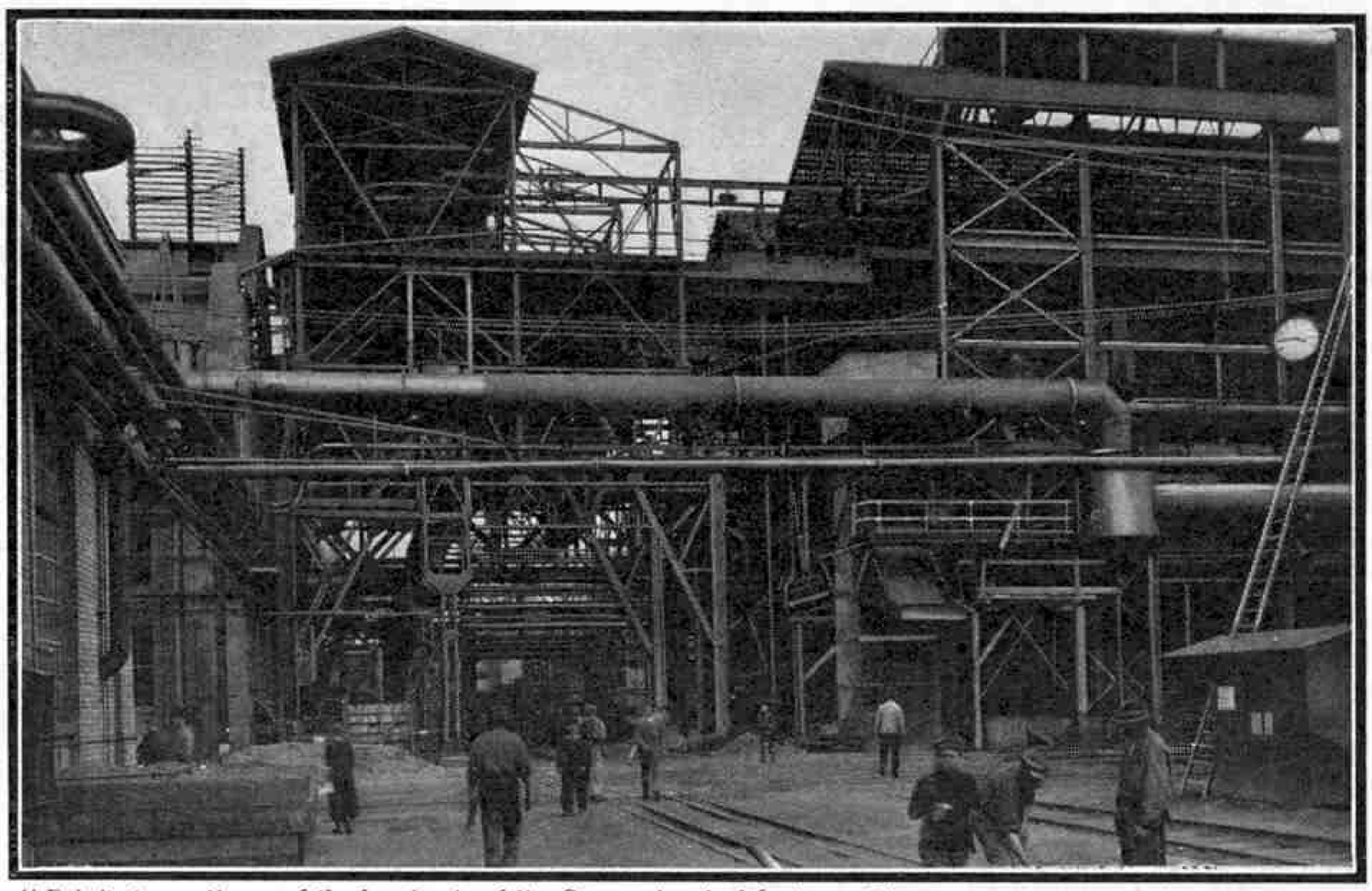
Another interesting device that is calculated to lengthen the life of an electric lamp is a shock absorber for use in places where vibration is liable to cause breakage of the filament. In this the supporting flex is mounted on a curved strip of spring steel that absorbs vibrations before they reach the lamp and thus prevents them from causing damage to the delicate filament.

Food From The Air

Germany's Vast Synthetic Chemical Plant

By W. G. Moore, B.Sc.

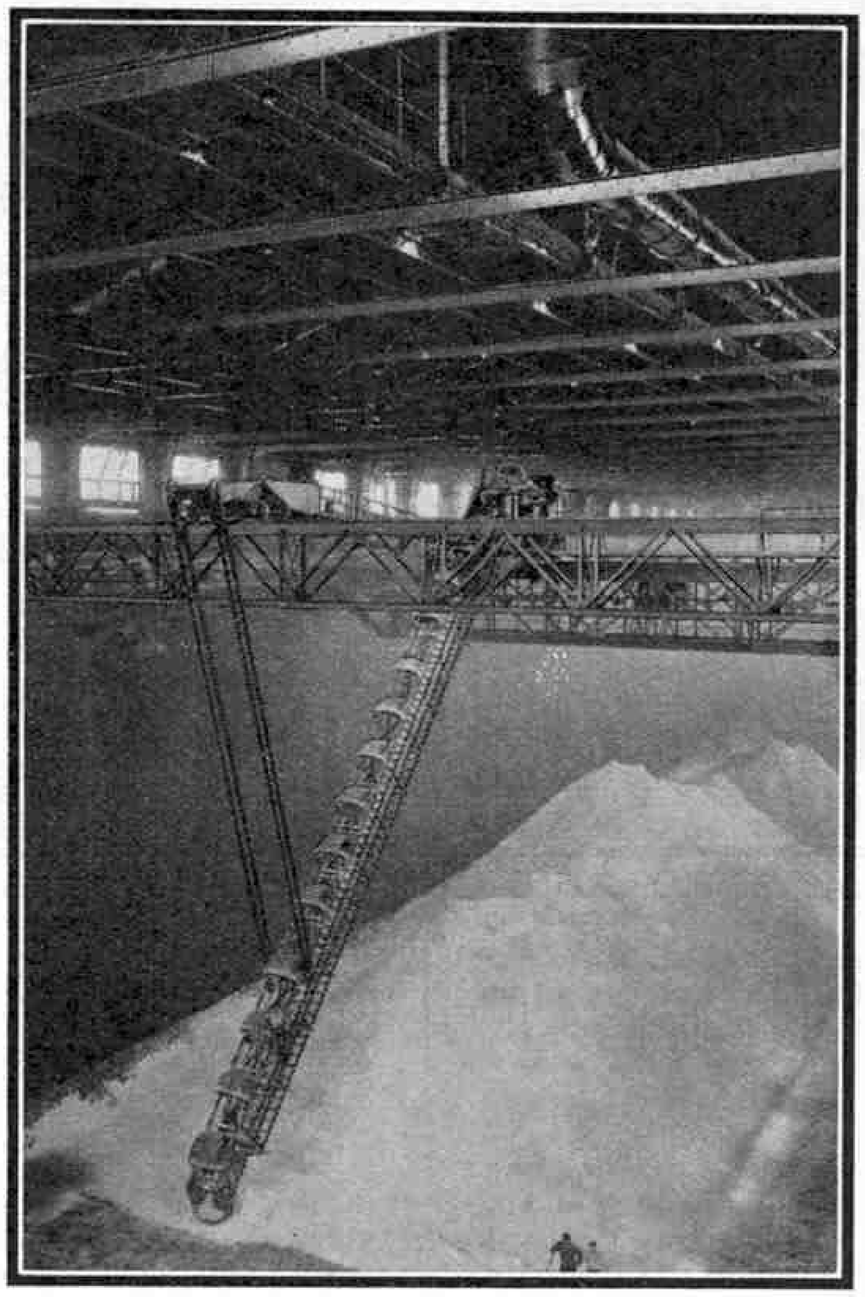
TWENTY-TWO years ago a German chemist perfected a process by which air could be turned into food. To-day, at the works of Germany's great chemical combine, the I. G. Farbenindustrie, may be seen the outcome of his magnificent research—the production of about 10,000 tons of ammonium sulphate each day of the year. Even when the barren deserts of Chile have been denuded of their last hundredweight of nitrate, Germany's crops—and her people—will not go hungry. The element nitrogen that is so essential to plant and animal existence is present in the atmosphere in an inexhaustible quantity; in I. G.'s gigantic plant it is being utilised to feed the country's wheat, rye and potato fields, in the form of chemical fertiliser.



"Fabrikstrasse," one of the by-streets of the Oppau chemical factory. The greater part of its length is darkened by a network of overhead pipes.

The Oppau factory, on the bank of the Rhine, covers nearly a square mile of ground. On a recent visit I approached it from the offices at Ludwigshafen, making use of one of the fleet of cars that I. G. thoughtfully provide for officials and visitors; and on noting its extent I was astonished to learn that there is a similar works at Leuna, Saxony, only larger! This Oppau factory is in reality a town, a well-planned conclave of power-houses, engine-houses, tanks and towers, with a wide central thoroughfare running from end to end and innumerable streets branching to right and left. Down all the main by-roads run railway-lines; overhead is a reticule of pipes, from the thickness of a man's wrist to a dozen times the thickness of his body. As my guide led me down the highway I remarked that each street was appropriately named—"Silostrasse," "Salpeterstrasse," "Ammoniastrasse—according to what was going on in its buildings.

We came after a half-mile walk to the starting-point of the process, where the three raw materials, air, water, and coal, are first harnessed. Down an ill-lighted tunnel below one of the buildings, we passed, through a maze of pipes, the producer-gas and water-gas generators. These enormous ovens are filled with red-hot coke. Through the former air is blown, and a gas rich in nitrogen is produced; through the latter air and steam pass alternately, and a gas rich in hydrogen results. From the nitrogen and hydrogen comes the synthetic ammonia, the basis of the life-giving nitrogenous fertiliser.



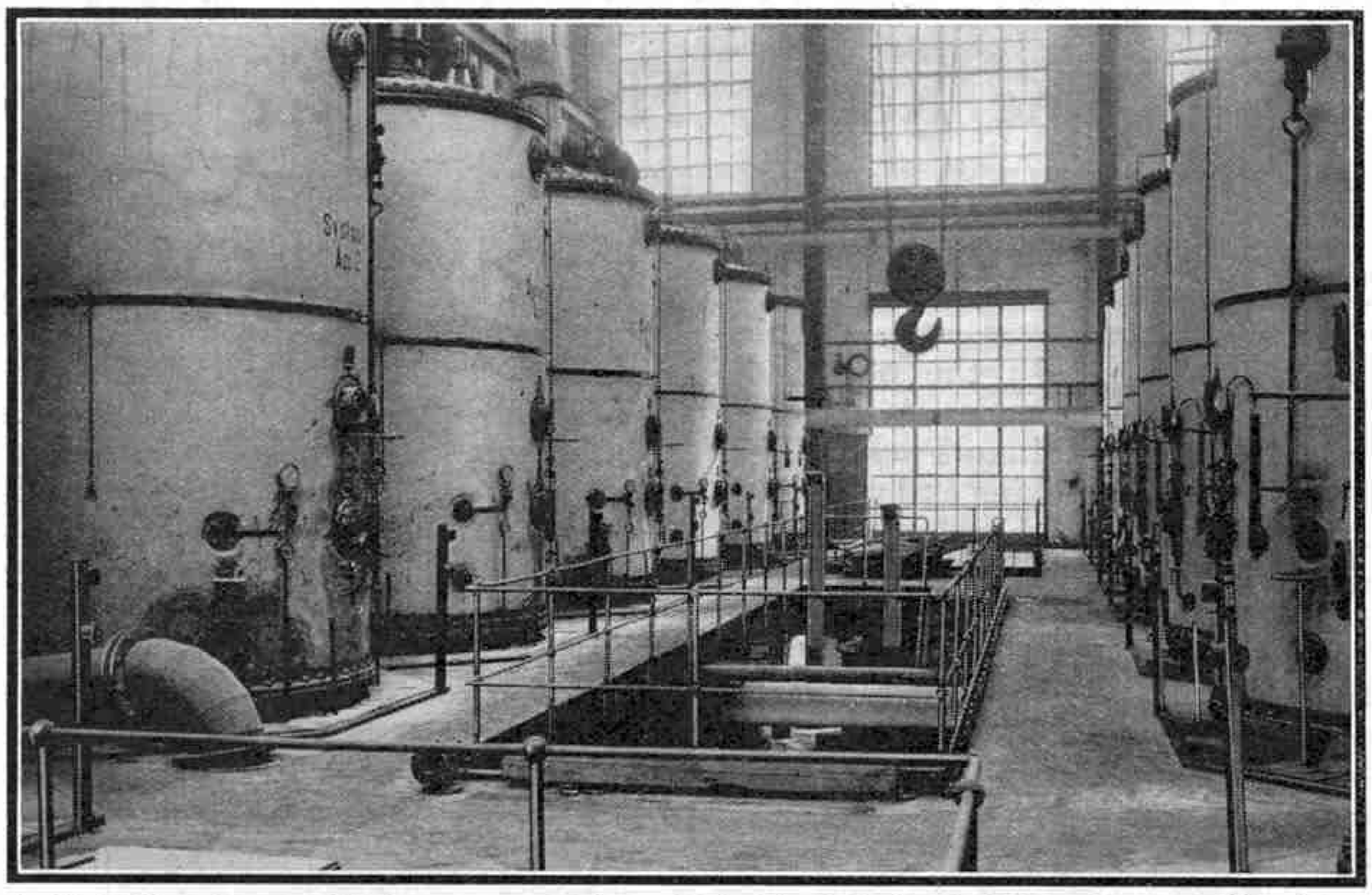
One of the vast silos, or storage pits, showing the heap of chemical fertiliser and the moving belt that brings it there.

Some of the generators were working, and the regular "clink, clink" of the turning grills, and the tiny lamps illuminating the caverns between them, made the scene like an elfin grotto. Other generators were being emptied. Out of the furnace mouths belched forth a blast of torrid air and a blinding glare, while from their depths half-naked men raked out the spent ashes, saturating the air with flying coke-dust. It was impossible to stand for more than a few seconds in this choking, fiery miasma.

A stone's throw away is the source of the nitrogen supply, where every minute thousands of cubic feet of air are sucked in from the atmosphere by enormous steam-driven pumps. In this building there is perpetually a deafening, grinding roar, and

people can only communicate by signs, or by yelling into each other's ears. The guide gesticulated fluently in explanation; but, standing by the side of a 20-ft. rotating flywheel and looking into the mouth of one of those colossal suction-pipes, I found my powers of concentration undoubtedly weakened!

That mechanical bedlam was left behind, not without relief. Then, while we were crossing the broad "strasse," there came a crashing bellow, the sunlight was eclipsed, and a thick shower of dark, gleaming crystals fell around us. "One of the coke generators has just been blown," explained my guide. Now it was possible to comprehend why the ground within a radius of 200 yards of this spot is lavishly carpeted with coke-dust.



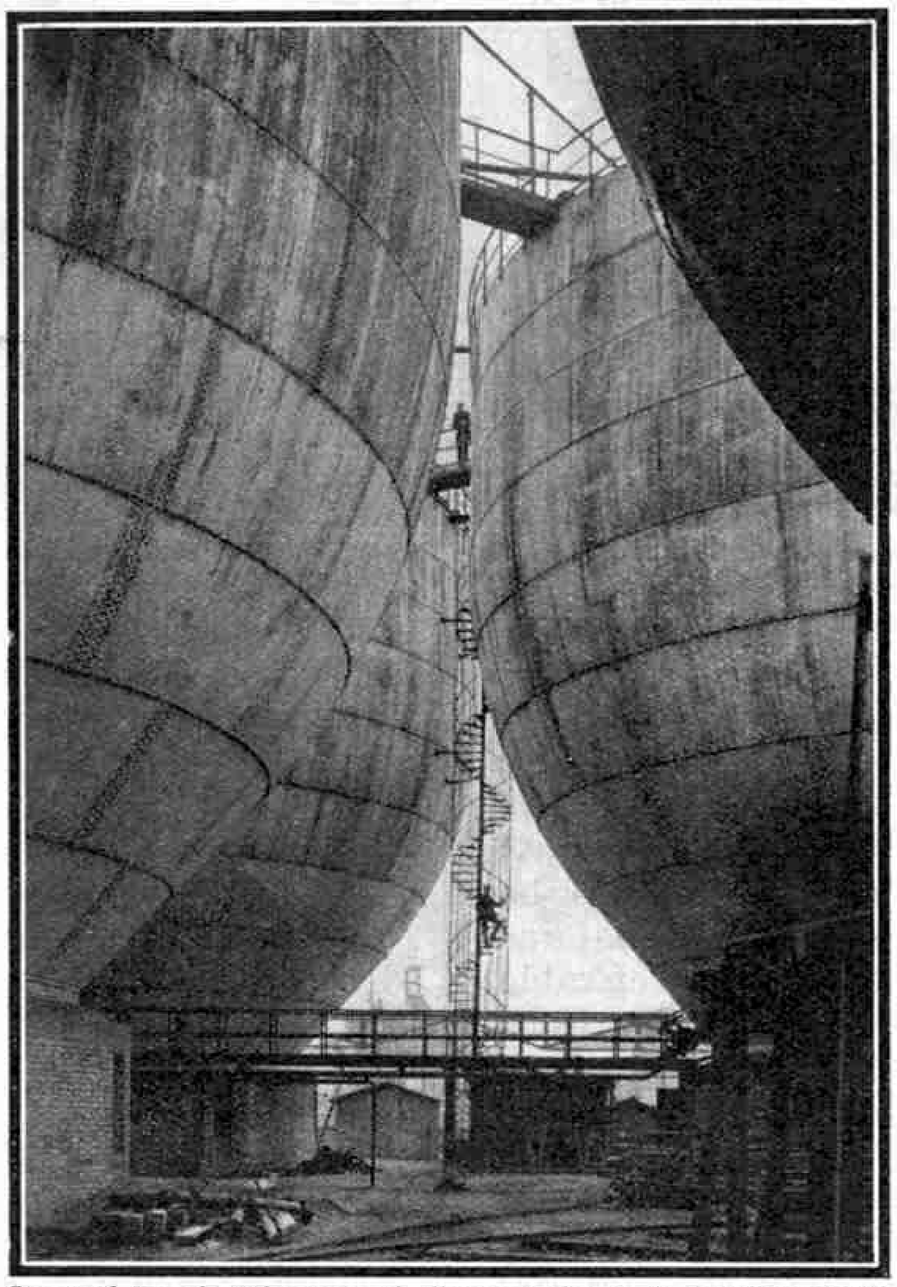
In this building nitrogen and hydrogen gases are being purified. The air is at tropical heat as the result of the violent chemical action in the tanks.

We now followed the nitrogen-hydrogen mixture to towers where it is "scrubbed" with running water, and thence to the gasometers. And what gasometers! A single one of them holds 2,000,000 cu. ft.—as much coal-gas as would supply a town of 100,000 people for two days. Yet it is emptied and refilled every hour!

With the gases is a large volume of carbon monoxide, from the coke generators, which must be eliminated. This is done in a room filled with white, cylindrical tanks, where the atmosphere is at a tropical heat, yet unnaturally still. You may stand there for hours in unbroken silence; not a workman is visible, for none is needed. Inside the tanks steam in the presence of iron oxide is converting the carbon monoxide to the dioxide, which is easily liquefied by compression and taken out. Seated before a switchboard in a cellar are the three men who, by reading and controlling the temperatures, manage the whole of this great chemical mechanism. Each hour 100,000 cu. ft. of gas pass through their hands, though they are never within yards of any of it.

The nitrogen from the generators is not sufficient for the needs of the fertiliser, and has to be supplemented by pure gas; this is again made from the air, by Linde's liquefaction process. In the factory where the liquefaction of air takes place the workmen can make snowballs while the thermometer bakes in the eighties! By compressing the air to 200 atmospheres, and allowing it to expand suddenly, it is cooled down to about 300 degrees below zero Fahrenheit; then it changes from its ordinary gaseous state to a colourless liquid, and the intense cold causes thick, solid snow to form round the pipes.

Now the volume ratio of nitrogen to hydrogen has been brought to one to three, at which the gases combine to form ammonia, and they still remain from the previous process at a pressure of 200 atmospheres. They are then pumped to the so-called "contact ovens," where the ammonia is produced. Fifteen high, thick-walled steel cylinders, enclosed in reinforced concrete, hold the magic substance that effects the change. It is iron oxide, and mixed with it are tiny, pin-head pieces of molybdenum, an extremely rare metal. To prevent risk of explosion, the outer chambers are always left open. Again and again the gases circulate through the ovens, fresh nitrogen and hydrogen continually entering as the ammonia is driven off. The operation is automatically controlled by valves and measuring instruments tended in an adjoining building by a few vigilant workmen.



Some of the gigantic ammonia liquor tanks, each holding 175,000 cu. ft. Their size may be gauged from that of the men on the stairway.

With regard to the precaution just mentioned, it may be recalled that this Oppau factory was once the scene of one of the worst explosions in history, and that the disaster probably originated in a gas-compressor leading to the contact ovens. At 7.30 a.m. on 21st September, 1921, a column of flame was seen suddenly to shoot up into the sky from the factory; then there was a terrific detonation, followed a few seconds later by another. Buildings for miles around were completely shattered, Oppau was like a town devastated by war, and to increase the horror a thick pall of ammonia fumes and grey fertiliser dust overhung for days. More than 800 people were killed and 2,000 severely injured, one whole trainload of workmen being buried (Continued on page 340)

Filling 1,400 Cement Bags Per Hour

The Rotary Fluxo Packer

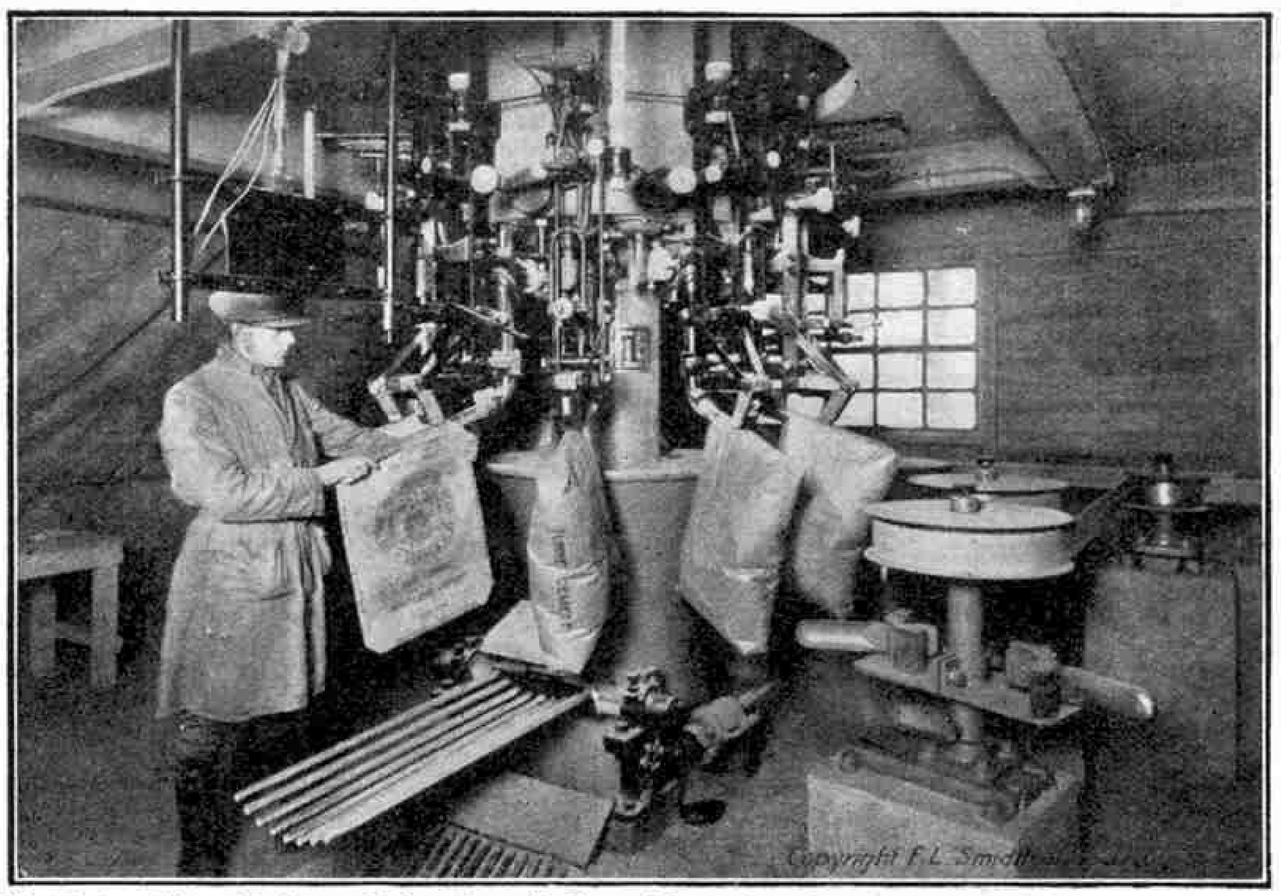
AMONG the most interesting features of modern industry are the machines that have been specially developed to carry out processes at a higher speed than is possible by hand, with the object of coping with an ever-increasing demand. A notable machine of this type is the Rotary Fluxo Packer that has been designed for the automatic packing and weighing of cement, ground lime, ground phosphates, soda ash, and similar finely-ground materials, into valve bags of paper or jute.

Before describing the packer it will be of interest to mention briefly some of the problems that had to be solved by the designer of an automatic machine of this nature. In the first place the cost of the paper or jute in an ordinary valve bag is far greater than the cost of the labour in manufacturing the bag, and consequently any saving in the size of the bag is important. It is therefore necessary that the packing machine should fill as much as possible into any particular size of bag. In the second place the machine must be capable of consistently accurate weighing, because short weights mean incessant complaints, and excess weights mean extra cost. All packing plants must contain a hopper above the actual packer; a suitable dust extraction installation; conveyors for bags, and a packing platform. The cost of these items does not vary very much with the capacity of the packer, and therefore a large packer is more economical than a small one. Finally it is important that the construction of the machine must be absolutely reliable, as orders usually have to be executed without any delay. A machine that contains only parts that rotate slowly is therefore preferable to one containing parts exposed to wear as the result of their rapid movement in the material to be packed.

In the design of the Rotary Fluxo Packer these and other important problems have been solved in a very interesting manner. Most packing machines for valve bags work with three filling spouts on which the bags are more or less suspended while the material is filled into them. When the material flows into the bags rapidly, a good deal of air is passed into the bags at the same time, and this air takes up space that should be occupied by the material. To obviate this drawback the Rotary Fluxo Packer has been designed with 10 or 12 spouts, and although the machine fills from 1,200 to 1,400 bags per hour, the time allowed for the filling of each one is a good deal longer than on the usual filling machine.

The powdered material that is to be packed and weighed is brought to a fluid state by the addition of a small amount of compressed air in conjunction with a mechanical stirring arrangement. The fluid material flows by gravity into the bags through the filling spouts, and by having a constant head in the supply hopper, the stream can be controlled as accurately as if the material handled were a real fluid.

In order to get the largest possible amount into the bags, the filling takes place in two stages. After the first filling the bag is nearly full. It is then rapped by small beaters on the outside, which causes the air to escape and the material to settle and occupy a minimum amount of space in the bag. After this the second filling takes place, and when the correct weight is obtained the lever on which the bag is suspended drops, and the flow of material is interrupted.



The Rotary Fluxo Packer, which automatically weighs and packs cement and similar materials at the rate of 1,400 bags per hour. For our illustration we are indebted to F. L. Smidth & Co. Ltd.

As will be seen from the accompanying illustration, the machine contains a cylindrical supply hopper on which the spouts are arranged. This hopper rotates round its own axis, and each filling spout in turn passes the attendant, whose sole duty is to place the empty bags on the spouts. One man, therefore, can comfortably handle as many as 1,400 bags per hour. In most packing machines the attendants can pull a lever and release the bag before it is quite full, which of course increases the apparent capacity, but spoils the accuracy of weighing. The capacity of the Rotary Fluxo Packer is governed by the speed of the machine and not by the skill of the attendant, and the accuracy of weighing cannot be interfered with, as the sacks are automatically discharged before they get near the attendant. The packer discharges the bags on to a chute, from which they may be taken direct to the wagons, or to a band conveyor that carries them to wagon, lorry or ship.

Our photograph shows the general arrangement of the machine. The attendant is seen placing an empty bag in position on one of the spouts, and the simplicity of this operation—the only one he has to perform—is evident. There will be noticed also the beaters that drive out the air that tends to take up space that should be occupied by the material.

Level Luffing Cranes for General Cargo

Interesting Examples at Middlesbrough Docks

CONSPICUOUS among the imposing array of cranes of various types to be found at all large docks are the tall jib cranes, the long slender arms of which tower upward to a great height. These cranes are an essential and interesting part of dock equipment, and are used for tipping and unloading a variety of merchandise classed as general cargo, and also for dealing with cargoes of timber and wood pulp.

There are many different types of jib cranes, but their general principle is that of a fixed or movable base on which is mounted a turntable supporting at one side the long overhanging jib that carries the load, and at the other side a platform or other provision for a counter-balancing weight. The majority of jib cranes are of what is known as the level luffing type, in which the load lifted by the crane is kept at a uniform height while it is being transferred from ship to shore, or vice versa.

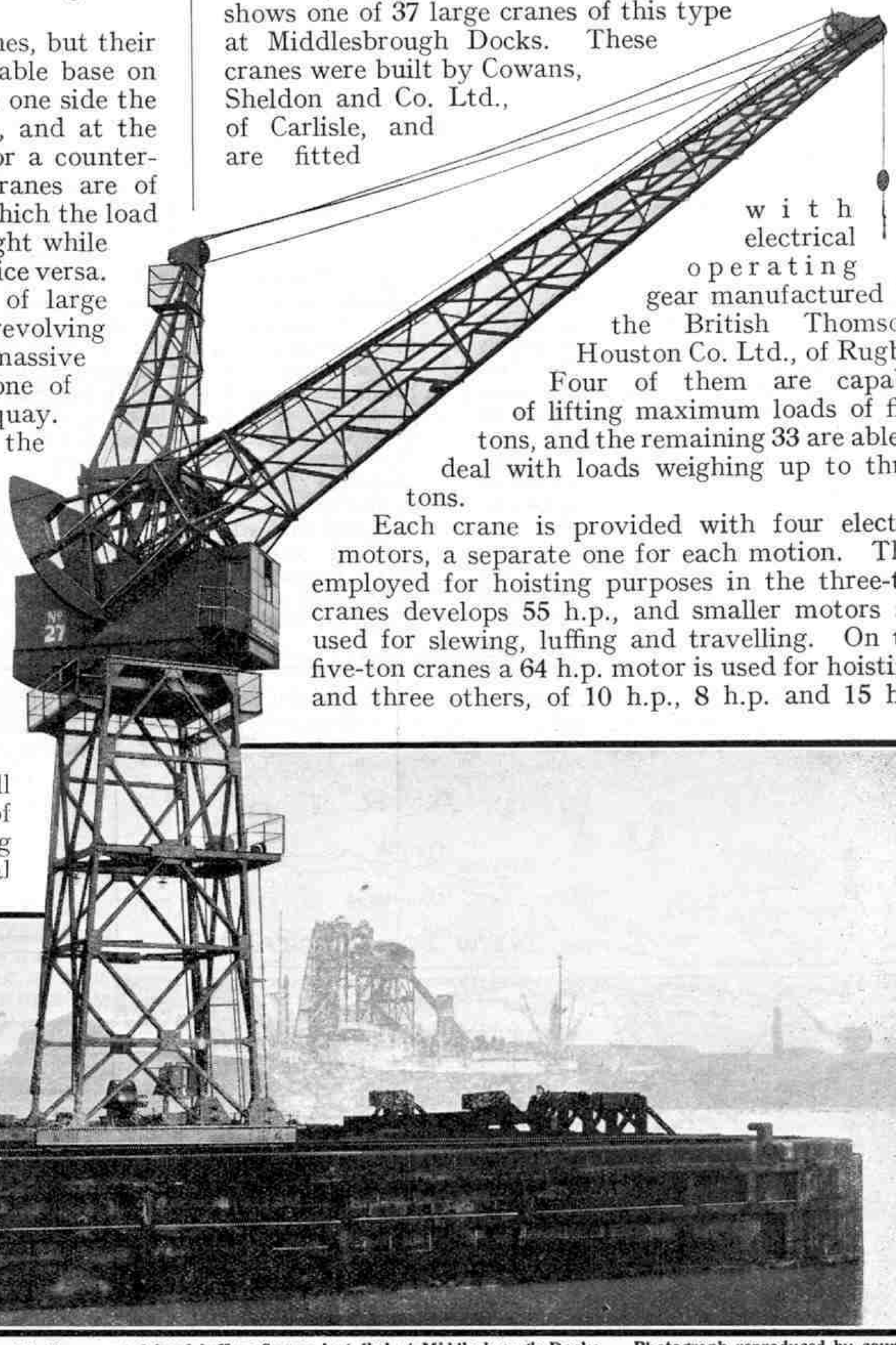
The level luffing cranes on the quays of large docks are usually mobile machines, the revolving superstructure being mounted on a massive braced pedestal that runs on two rails, one of which is placed close to the edge of the quay. The crane track is of broader gauge than the track traversed by the dock trains, and the portals in the sides of the crane pedestal extend well above the standard railway loading gauge. Trains and wagons shunted along the quay can therefore pass safely beneath the crane whether this is in operation or not; and similarly the crane can move along the quay even though the railway line it stands over is full of wagons.

The pedestal, superstructure and jib are built of steel sections rigidly braced in all directions, and huge girders on the top of the pedestal carry the roller path, slewing ring and centre pin. At its base the pedestal is secured to massive wheeled carriages built up of steel girders and provided at each end with screw jacks and rail clips.

The lifting capacity of dock-side level luffing cranes varies from one to 10 tons, and the radius of operation varies with the load. The cranes have four separate motions, hoisting, luffing, slewing and travelling, all of which are controlled from the driver's cabin on the revolving superstructure. This cabin is placed sufficiently to one side to give the driver an unobstructed view of the load in all positions. The hoisting and luffing barrels and other mechanism, and in the case of electrically operated cranes also the motors, for effecting the different motions of the crane, are situated in the machinery compartment at the base of the jib. The weight of the crane jib is perfectly balanced at any radius, and its raising and lowering is performed either by means of ropes from the jib or by crank mechanism.

Electrically-operated level luffing cranes are in use at many docks, and the accompanying illustration shows one of 37 large cranes of this type at Middlesbrough Docks. These cranes were built by Cowans, Sheldon and Co. Ltd., of Carlisle, and are fitted with electrical operating gear manufactured by the British Thomson-Houston Co. Ltd., of Rugby. Four of them are capable of lifting maximum loads of five tons, and the remaining 33 are able to deal with loads weighing up to three tons.

Each crane is provided with four electric motors, a separate one for each motion. That employed for hoisting purposes in the three-ton cranes develops 55 h.p., and smaller motors are used for slewing, luffing and travelling. On the five-ton cranes a 64 h.p. motor is used for hoisting, and three others, of 10 h.p., 8 h.p. and 15 h.p. respectively, are fitted in order to enable the three remaining motions to be carried out. All four motors on each crane are housed inside the operator's cab.



One of 37 electrically operated level luffing Cranes installed at Middlesbrough Docks. Photograph reproduced by courtesy of the British Thomson-Houston Co. Ltd.

New Bows for German Liners

Important reconstruction work is now being carried out on six big German vessels in the fleet of the Hamburg-Amerika Line, which are being lengthened by having new bows built on to them. The vessels concerned are four 22,000-ton transatlantic passenger liners of the "*Albert-Balin*" class, the "*Albert Balin*," the "*Deutschland*," the "*Hamburg*" and the "*New York*"; and two cargo steamships, the "*Miederwald*" and the "*Stiegerwald*."

The work on the vessels of the "*Albert-Balin*" class will increase their length by 39.4 ft. These ships maintain a weekly service between Germany and the United States, and elaborate arrangements have had to be made to execute the work with the minimum amount of inconvenience. It was decided to withdraw the vessels from service one at a time, for a period of two months, and to enable the work to be completed in the short time available the new bows were completed and laid down in a floating dock. The parts built in the dock were 79 ft. in height, 82 ft. in length and more than 600 tons in weight. The old bow of the vessel to be treated was then cut down nearly to the waterline while the ship was afloat, which took four days, and the remainder was cut off in a floating dock. This dock was then placed end on to the one in which the new hull had been built, and the bow was hauled into position by two capstans along sliding ways 131 ft. in length. This work was very difficult, as the two docks were not rigidly connected, and the correct trim and alignment of the two docks had to be carefully preserved. The "*Hamburg*" was the first to be treated, and in her case the whole of the reconstruction work was completed in the short period of 40 days' dock time.

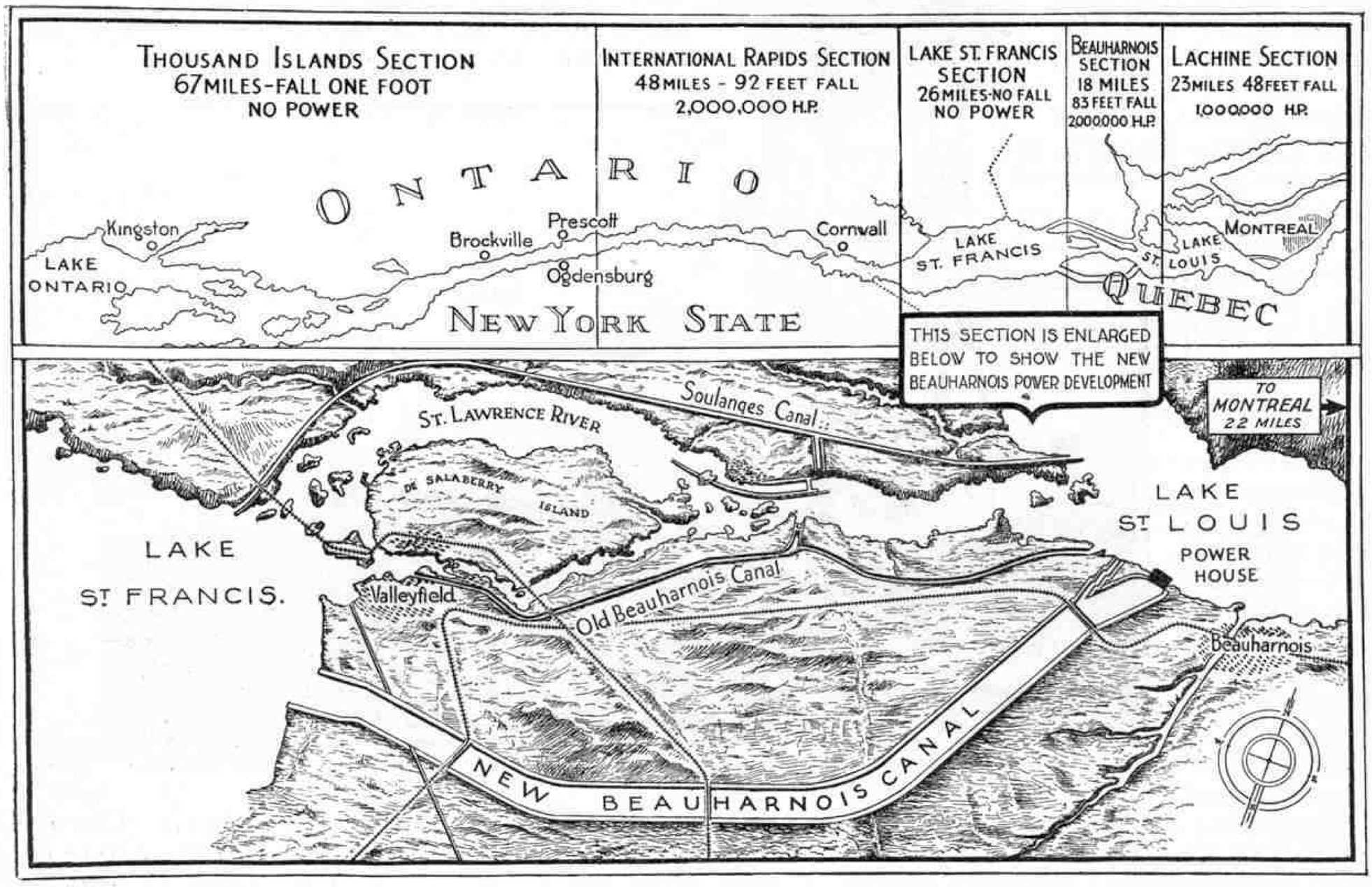
The length of the cargo vessels is being increased by only 20 ft., but the propulsion machinery is being converted to give 2,850 h.p., in place of 2,300 h.p. This increase will enable a speed of 12.7 knots to be maintained, an addition of nearly two knots, although the coal consumption will still be 36 tons per day as before the conversion. The extra power will be provided by the addition of a Bauer-Wach exhaust-steam turbine in each ship.

S.R. Paddle Steamer to Carry 900

Work is now nearing completion on a paddle steamer for the Southern Railway Company, for operation on their service between Portsmouth and Ryde in the Isle of Wight. This will be the sixth new vessel placed on the service during the last 10 years, the others being the "*Shanklin*," in 1924, the "*Marstone*" and "*Portsdown*" in 1928, and the "*Southsea*" and "*Whippingham*" in 1930. It will replace the old "*Duchess of Kent*," which was sold some time ago.

The new steamer will be 223 ft. long and 29 ft. broad, with a draught of 6 ft. 9 in., and will be capable of carrying about 900 passengers. She will be provided with first and second-class saloons, with special ventilation and heating apparatus to maintain the temperature at 65°F. at all seasons. Triple-expansion engines will be fitted, capable of giving the vessel a speed of 14½ knots. She is expected to be ready for service in July next.

The Portsmouth-Ryde service is maintained by seven paddle steamers, and in the summer they run every hour. The new vessels employed to operate this service mark a great improvement in the transport facilities between the mainland and the Isle of Wight, and that this is appreciated by the travelling public is evidenced by the remarkable growth in the number of passengers carried on the route. In 1913 the number of passengers conveyed was 845,000, while in 1930 this had grown to 2,212,914. The peak period is reached during August, and on the Saturday following August Bank Holiday week-end last year 46,658 passengers were carried, a record total for one day.



Sketch maps showing the general layout of the Beauharnois Power Scheme, an article on which appears on page 278 of this issue.

Fast Motor Boat for Thames Service

On page 11 of our issue for January last we gave brief details of a scheme for the operation of transport services on the River Thames by a fleet of fast motor boats known as "*Waterbuses.*" A motor boat suitable for such work has now been designed and built by Brooke Marine Motors Ltd., of Lowestoft. This boat is 55 ft. long and 13 ft. in beam, and has seating accommodation for 94 passengers. The hull and sides are built of pitch pine, and the roof is of a special aluminium alloy selected for ability to withstand corrosion. It is fitted with a sliding roof that can be opened in fine weather. A small cabin is arranged above the roof for the driver or captain, from where all the controls are operated, including the regulators for the automatically-worked gang planks by means of which access is gained to the boat. Two Brooke-A.E.C. oil engines each developing 130 h.p. are fitted, giving the boat a cruising speed of about 15 m.p.h. when carrying a full load.

A Motor Highway Across Canada

It is expected that by next autumn motorists will be able to traverse the whole of the 4,000 miles that separate the maritime provinces of Canada from the coast of British Columbia. For years the various provinces have been co-operating on the construction of this trans-Canadian highway, and now the various links are being welded here and there. At the head of the Great Lakes the road takes the form of a ferry for a distance of 300 miles, but the cars are never lifted from their wheels, and the occupants need never leave their seats. The only incomplete section at present is a short strip of 40 miles in Ontario, where one third of the highway lies. This little stretch is over barren rocky ground and it may be several months before the road can be laid.

Some 12,000 men are employed in road camps on the work at present, but it is probable that in the final rush to finish as soon as possible the present number will be doubled.

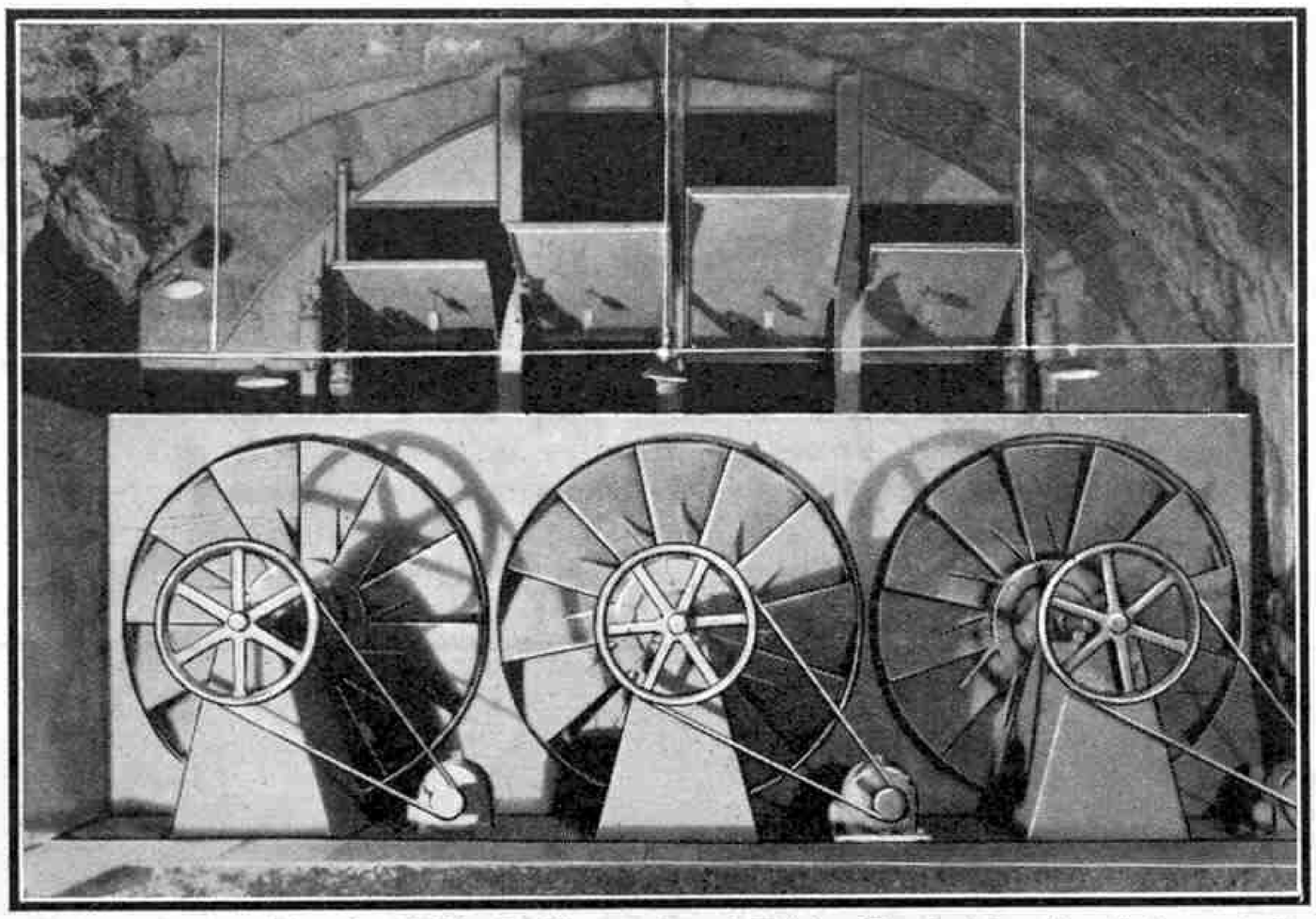
* * * *

During the construction of the Golden Gate bridge at San Francisco, radio will be used to enable the engineers to communicate with men at work on the piers far out in the bay.

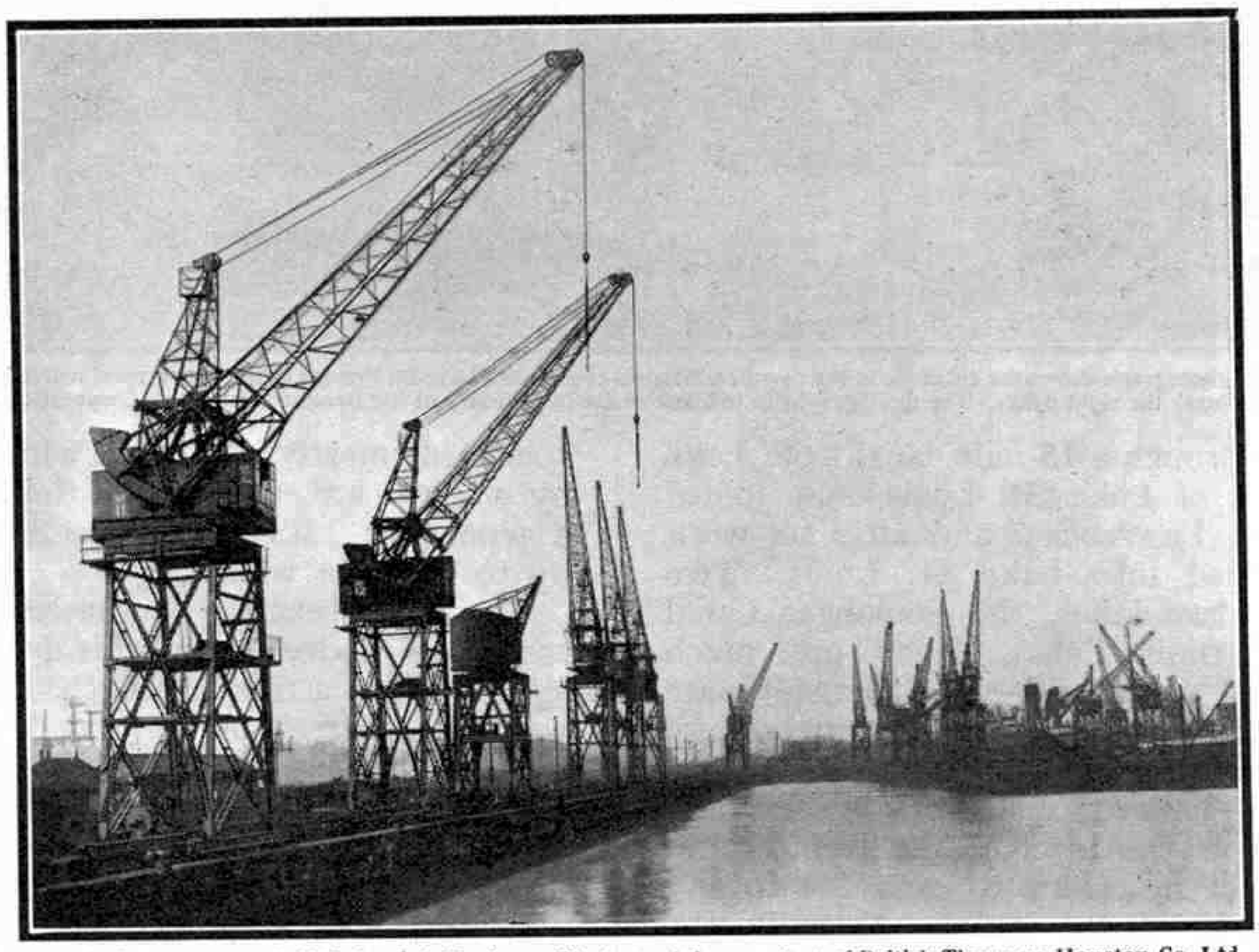
Opening of New Mersey Tunnel

It is hoped that the great new tunnel under the Mersey, one of the most ambitious engineering feats of modern times, will be opened early in July by the King, who will also open a great new arterial roadway connecting Liverpool and Manchester.

Readers will remember that this new tunnel has been driven under the Mersey between Liverpool and Birkenhead to form an important link in a great thoroughfare from the east coast of England into Wales. Cars travelling through the tunnel will complete the journey in 6½ minutes if they keep up a speed of 20 m.p.h., whereas by the present ferry the time taken is between 30 minutes and an hour. The tunnel can carry four lines of traffic and is capable of dealing with 4,000 vehicles an hour.



The fan shutters and fans installed in the Wawona tunnel, U.S.A. The electric motors that operate the fans were made by the General Electric Company of New York, to whom we are indebted for this illustration.



Level luffing cranes at Middlesbrough Docks. Photograph by courtesy of British Thomson-Houston Co. Ltd. See special article on page 275.

Britain's Biggest Motor Coaster

The "*British Coast,*" recently built at Leith, is the largest motor coaster in Britain. She is 230 ft. in length between perpendiculars, and has a deadweight capacity of 1,400 tons. In spite of this comparatively large deadweight however, she has a draught of only 13 ft. 11 in., which enables her to go into many ports that are inaccessible to most vessels of her size.

In the construction of the "*British Coast*" electric welding has been extensively employed. Her equipment is the most up-to-date available, and special attention has been paid to the question of launching the two lifeboats under difficult conditions. For this purpose special mechanical davits have been installed that push a boat outboard and at the same time automatically lift it clear of the chocks, the entire operation being carried out by one man. The apparatus ensures that the boat cannot fall inboard even when the ship has a list of 30 degrees. The wireless equipment consists of a radio-telephone apparatus and a radio direction finder that can be employed either on the bridge or under the control of the wireless operator. The propelling machinery consists of two engines that develop a total of 1,250 b.h.p. at 220 r.p.m. and drive two screws.

Straight Tunnel Nearly One Mile Long

The Wawona tunnel in the United States is one of the longest straight tunnels in the world, being absolutely straight for its whole length of 4,233 ft. It is cut through solid granite for the entire distance, and was constructed to make possible a road with a minimum gradient of 1 in 20 from Fresno and Los Angeles to the Yosemite Valley by way of the Wawona Big Trees.

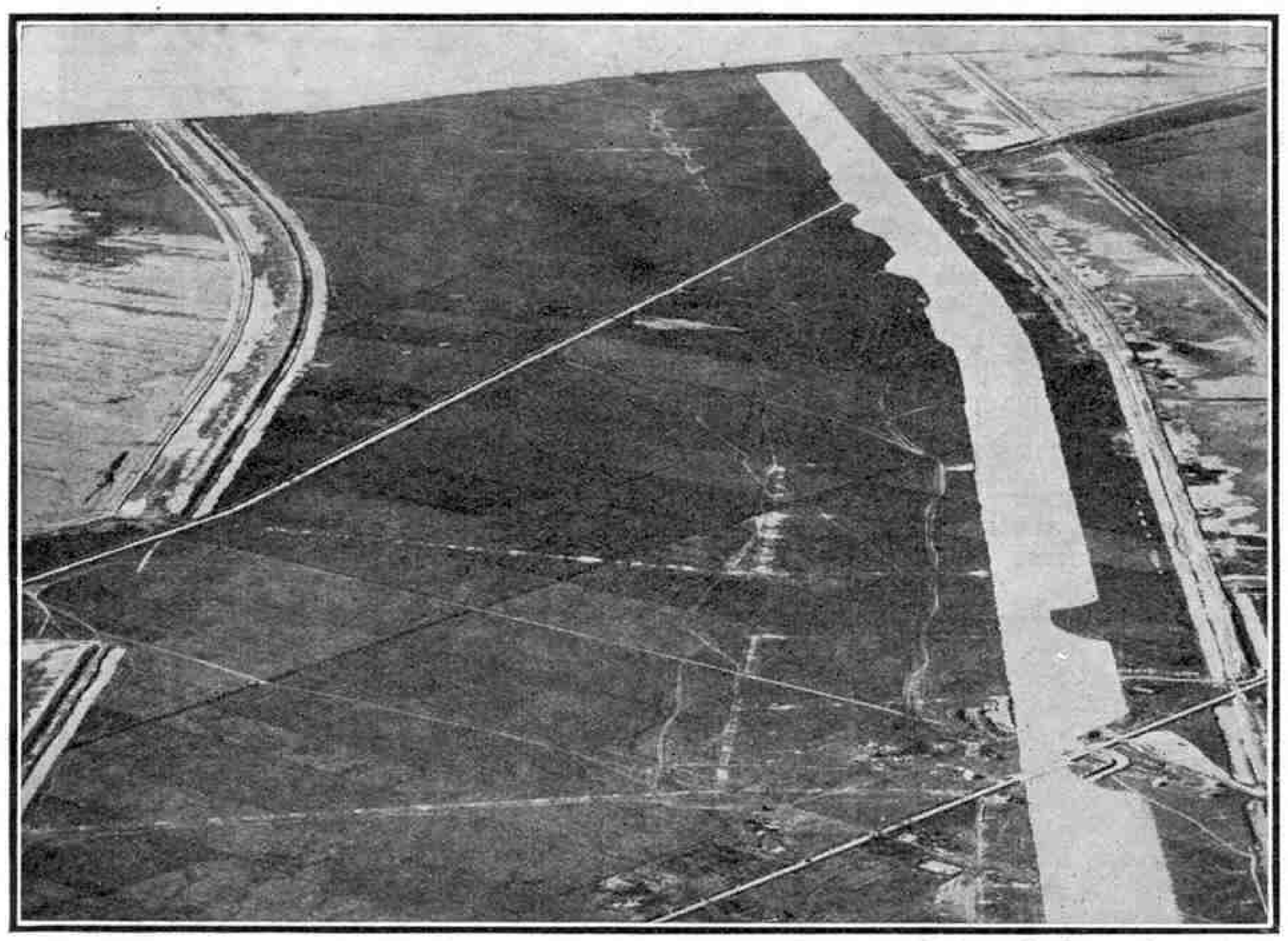
The tunnel takes a 24-ft. roadway and a 3-ft. pathway. To protect pedestrians and passengers in motor cars from the effects of carbon monoxide, gas detectors are installed that automatically operate special mechanisms to close the dampers, open the fan shutters and start the fans when a certain percentage of gas is present in the tunnel. This operation is reversed when the air becomes purified, the fans being shut off. The fans are installed in a ventilation tunnel drilled to the face of the cliff at about the centre of the main tunnel, and a photograph of them appears on this page.

Great Canadian Hydro-Electric Scheme

The Beauharnois Power Station

THE Beauharnois hydro-electric scheme in Canada is one of the most extensive projects of its kind that have been undertaken in any part of the world. The station is situated on the southern shore of Lake St. Louis, a small lake about 20 or 30 miles from Montreal, and the power generated serves in particular the requirements of Toronto and Montreal, the two largest cities in Canada. In addition a canal that has been constructed to supply water to the power house is available for shipping, and forms an important link in the navigation facilities of the St. Lawrence waterway.

The power scheme is not yet fully developed, but the section that has been completed is now yielding nearly 220,000 h.p. The water supply available is capable of developing 500,000 h.p., but by deepening the canal along which the water is led a total of 2,000,000 h.p. could be made available. The water that drives the turbines is drawn through a 15-mile canal from Lake St. Francis, south-west of Lake St. Louis, and joined to it by the River St. Lawrence; and after its work is done it is discharged into Lake St. Louis. Two other canals join the two lakes, the Soulanges Canal and the Old Beauharnois Canal. They are much smaller than the new one which, if dredged to its ultimate capacity, would completely divert water from both of them and also from the course of the River St. Lawrence.



This photograph shows the entrance to the new Beauharnois canal, with Lake St. Francis in the background and the ship canal near the right dyke. The photographs in this article are by courtesy of the Beauharnois Power Corporation Ltd.

Most of the ground between Lake St. Francis and Lake St. Louis is below the level of the former, and consequently it was not necessary to excavate to any great extent the whole of the canal. Actually the route chosen varies between 3 ft. and 15 ft. below the level of Lake St. Francis, except for a short stretch of some 400 yards. On account of the low level of the ground it was possible to follow a very interesting plan in the construction of the canal. This plan consisted of the erection of two dykes or embankments between the two lakes. These embankments are nearly 3,000 ft. apart, and at no point are they more than 24 ft. high. In order to prevent erosion the inner sides were lined with rock.

The embankments were constructed mainly by drag scrapers, which formed a trench with a mound on each side of it on both sides of the canal. The Ship Canal, which is 27 ft. deep and 600 ft. wide, and lies near the north dyke, was then excavated by a suction dredger that floated on water allowed to flood the space between the inner mounds. The spoil from the dredger was discharged into trenches, and eventually piled so high that an embankment was formed on each side.

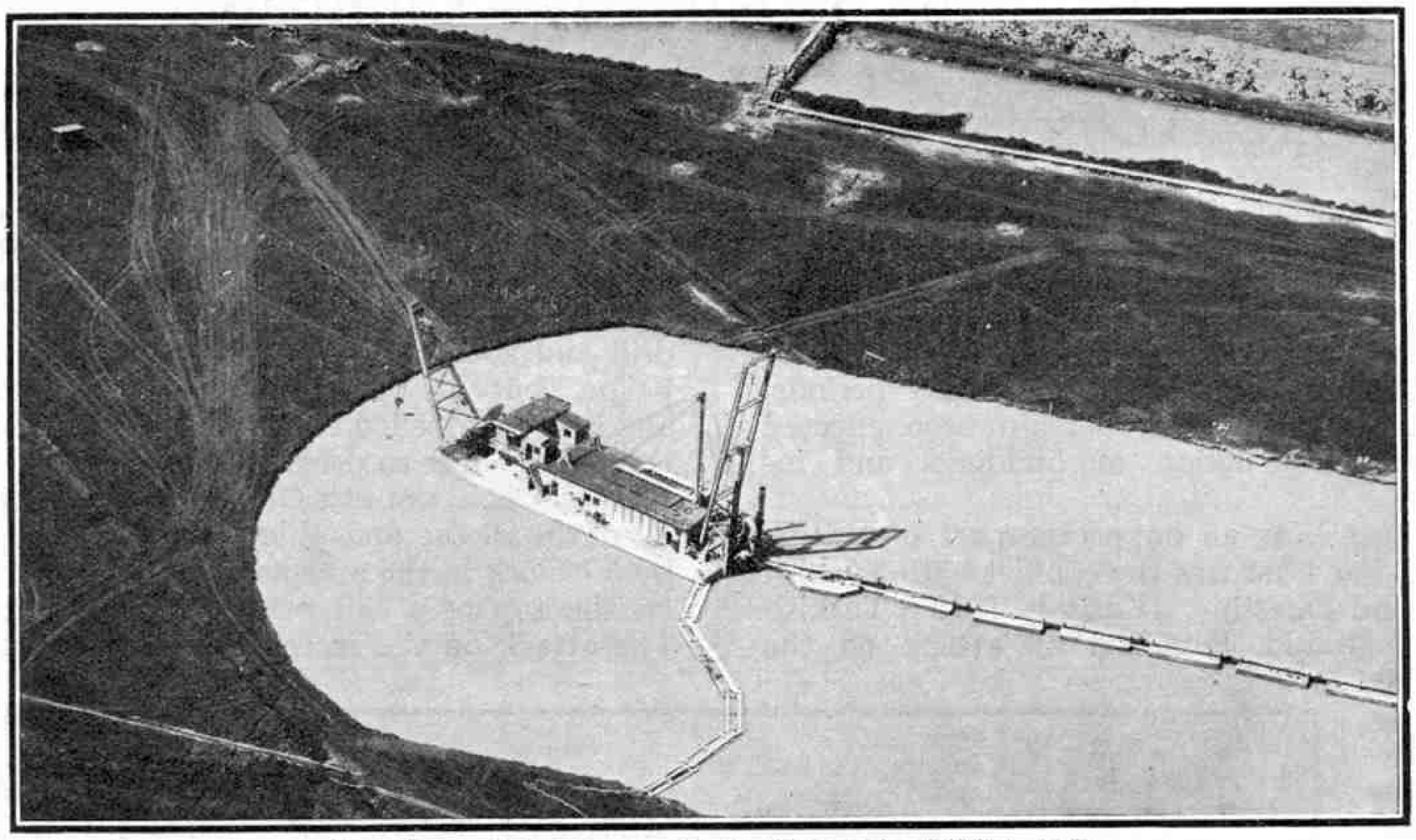
The dredger installed for the work had a capacity of 1,100 cu. yds. per hour, and was capable of excavating 819,000 cu. yds. in a month. The canal was first cut 300 ft. in width, and the dredger often moved forward as much as 200 ft. per day. The cutting head on the machine was 7 ft. in diameter, and it was operated by a 300 h.p. motor. The spoil consisted mostly of clay, which was pumped away by a 2,000 h.p. motor into the settling basins through a pipe over 2 ft. in diameter, capable of taking rocks up to 18 in. in width.

The entire excavation necessary in the bed of the canal was carried out by this dredger, except for a short stretch about a mile in length. In this section boulders were encountered in the clay, and it was necessary to excavate the canal " in the dry." For this purpose two large electric draglines were employed, equipped with buckets with a capacity of 4 cu. yds. and 5 cu. yds. respectively. Most of the rock taken out by these machines was employed to line the sides of the embankments.

Some idea of the size of the undertaking may be gained from the fact that during 1930, which was the first season, the material handled by the various machines exceeded twice the cubic contents of the great pyramid of Egypt, a daily total of more than 60,000 cu. yds. often being dealt with. This amount is the equivalent of the cubic contents of a 10-storey building occupying a site 120 ft. square. In addition to the actual movement

of material the work completed during the first year's operations included the erection of five big construction camps providing accommodation for the 2,500 workmen employed; the erection of one of the largest hydraulic dredgers in the world; the laying of 40 miles of construction railway; and the assembly and erection of all the large-scale equipment designed to handle material along the route of the canal, and to construct the power house.

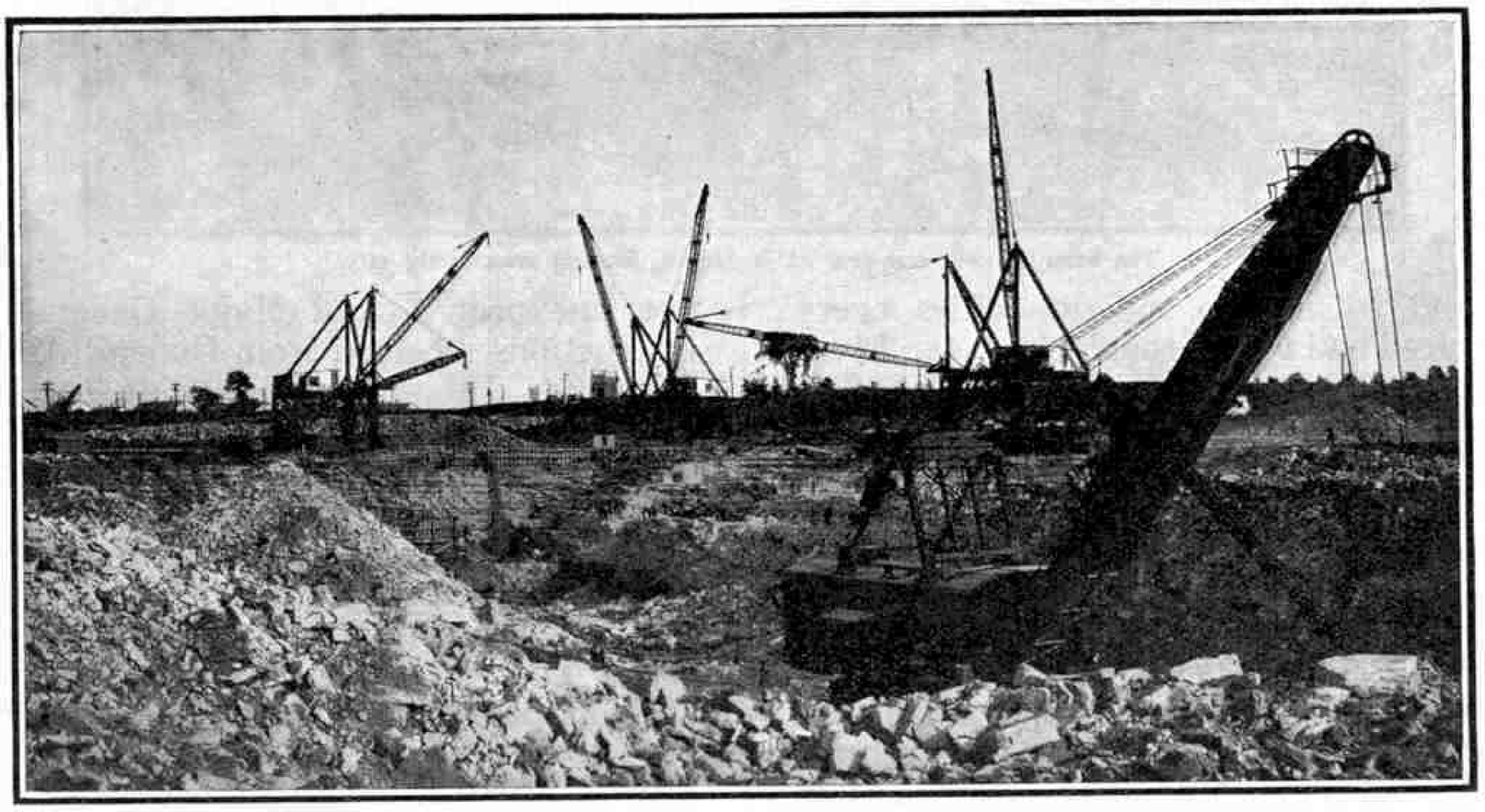
The task of building the tailrace and the power house formed the second part of the scheme. The tailrace is on the downstream side of the plant, and during the work on it a large quantity of rock was taken out and employed for the foundations of the power house. The electric shovel used for this work had a bucket with a capacity of 10 cu. yds., which means that two buckets full were sufficient to fill a railway truck. The spoil was loaded into trains, and as each train was filled it moved off to the rock dump, or to the crusher if the rock was intended for use in making concrete, and another train steamed into place. The bucket of the excavator was carried on a boom 93 ft. long and weighing more than 80 tons. The total weight of the machine was 550 tons, and it was driven by an electric motor which normally developed 680 h.p.



Excavation work in progress on the Ship Canal, which is 27 ft. in depth.

The excavation for the actual power house was about 1,000 ft. long, and went down for a distance of 65 ft., rock from the tailrace being used for part of the foundations. A handsome building about a quarter-of-a-mile long has been built on this site, and at present it contains four 50,000 h.p. vertical turbo-alternator sets and two 8,000 h.p. sets, the smaller ones being employed as "house" sets to provide the necessary power for lighting and internal requirements generally. Provision has been made in the building for the addition of six more 50,000 h.p. sets, which would bring the total output up to 550,000 h.p. As already stated, however, if the canal were dredged to a depth of 27 ft. for its full width it would take the whole of the river, and 2,000,000 h.p. would be available.

The first power generated at the Beauharnois Station was delivered according to schedule on 1st October, 1932, little more than two years after the work was commenced. The first delivery was to the lines of the Montreal Light, Heat and Power Consolidated, and was under a contract for 35,000 h.p. This is to be increased each year until eventually 150,000 h.p. will be provided. Shortly after this requirement had been met, 25,000 h.p. was supplied to the Ontario Hydro-Electric Power Commission under a contract that eventually will amount to 250,000 h.p. This Commission is dealing with the supply of power to places on the eastern boundary of the province of Ontario. The power will be carried for a distance of 300 miles at 220,000 volts to a station near Toronto, from which it will be distributed. It is interesting to note that this is the highest voltage transmission line now in use in Canada.



A striking photograph of excavators at work.

The Soulanges section of the St. Lawrence, as the stretch that connects Lake St. Louis and Lake St. Francis is known, has been harnessed in the service of man for a long time and there has been a canal between the two lakes for more than 150 years. This was built in about 1800 by the Seigneur of Beauharnois to give a constant supply of water for a grist mill that he had erected on Lake St. Louis.

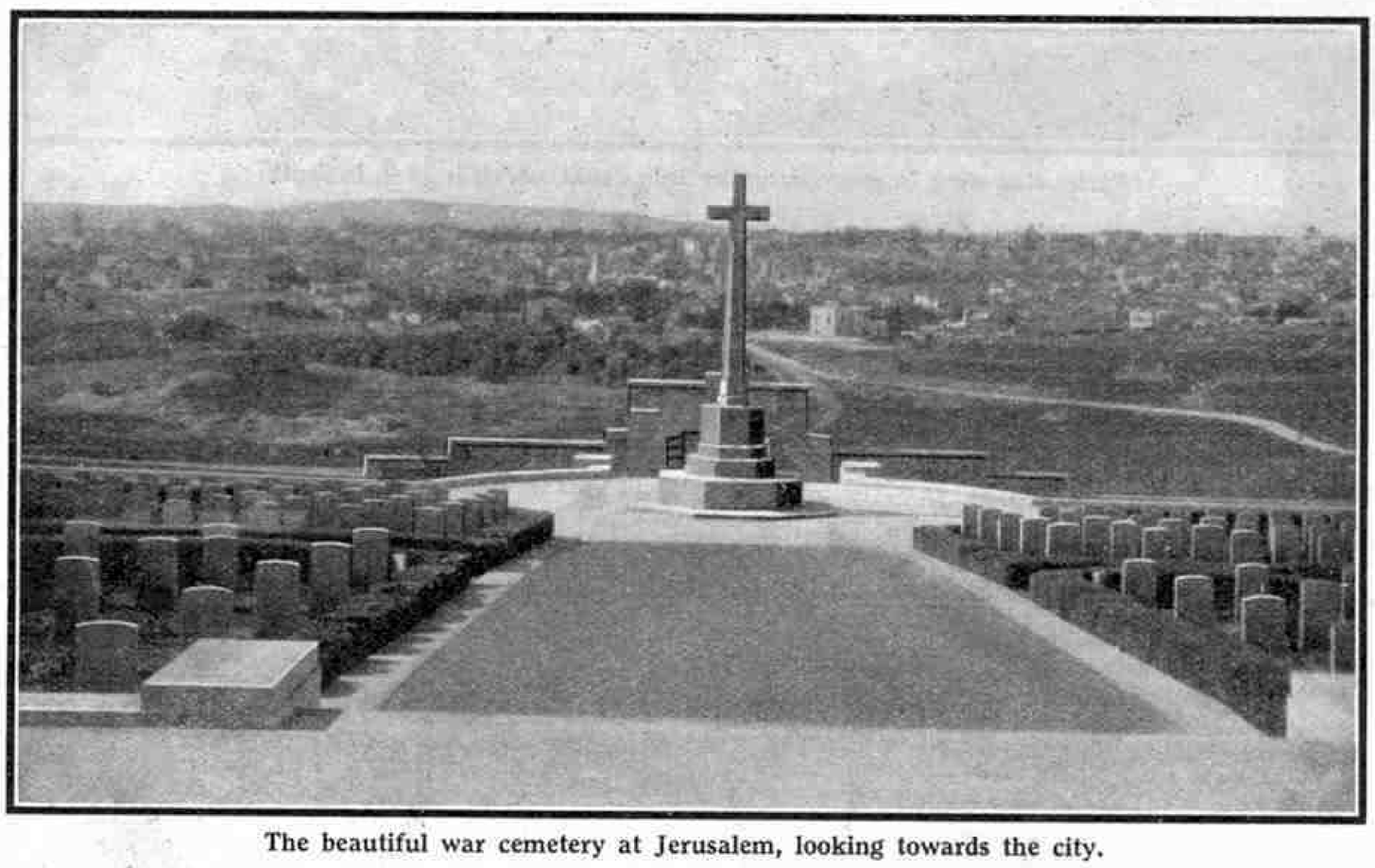
The War Cemetery at Jerusalem

A Reminder of Allenby's Campaign

By Henry H. Marsh

THE city of Jerusalem, sacred to Christians, Jews and Moslems, has been besieged and captured at some time by almost all the great nations of history. The Israelites, Egyptians, Babylonians, Greeks, Persians, Assyrians, Saracens, Romans, Crusaders and Turks have ruled the city for long or short periods, and seldom has a change of ownership been effected without wholesale destruction of buildings and inhabitants.

During the Great War an important part of British operations in the Far East was the conflict with Turkish forces in Egypt and Palestine. Early in 1915 a Turkish force, with German aid, launched an attack on the Suez Canal. This was successfully repulsed, but to protect this important waterway from further danger the British Force in turn took the offensive. Month after month the pursuit of the slowly retreating enemy was maintained under conditions of great hardship and privation. The wheels of the guns sank deep in the soft sands of the desert; heat, dust and flies had to be contended with, and to add to the difficulties every gallon of water required had to be brought from the River Nile, for the retreating Turks destroyed the wells. The water was conveyed in very large tin boxes called "fantasses," which, like the food and other supplies, were carried by camels. Tens of thousands of these useful beasts were employed in this transport work by the British.



The beautiful war cemetery at Jerusalem, looking towards the city.

By June, 1917, the British Force had moved forward until they confronted a strong enemy position extending from Beersheba to Gaza, and it was at this stage that General Allenby was sent from France to take over the Palestine Command. A single line of railway was laid down from Jaffa, the canal base camp, and extended mile by mile as the army advanced. Over this line all the men, guns, ammunition and food were transported. By 5th December, 1917, the British Force had advanced to a line extending from Neby Samwil, the highest point in the neighbourhood of Jerusalem and 2,935 ft. above sea level, to a point about four miles south west of the city.

December is the rainy season in Palestine, and on 7th December there began a deluge that continued for three days. The rain made the roads impassable for camels and almost as bad for mechanical transport, while the heavy mist over the hills greatly limited aeroplane observation. The troops were still clad in the khaki drill and shorts they had worn during the desert campaign, but in spite of suffering severely from cold, and being compelled to subsist on bully beef and biscuits, they were eager to press the attack. This was begun in the early hours of 8th December, and went so well that by dawn all the first objectives had been captured, and by 5 o'clock in the afternoon the last one, an old factory on the top of a hill overlooking the city, was taken. The attack on the factory occupied the greater part of the day, for the Turks had installed there many machine guns that swept the slopes with a devastating fire. Large rocks on the hillside provided the only cover, and by dodging from rock to rock the British gradually approached the crest, and then with a final rush gained the position.

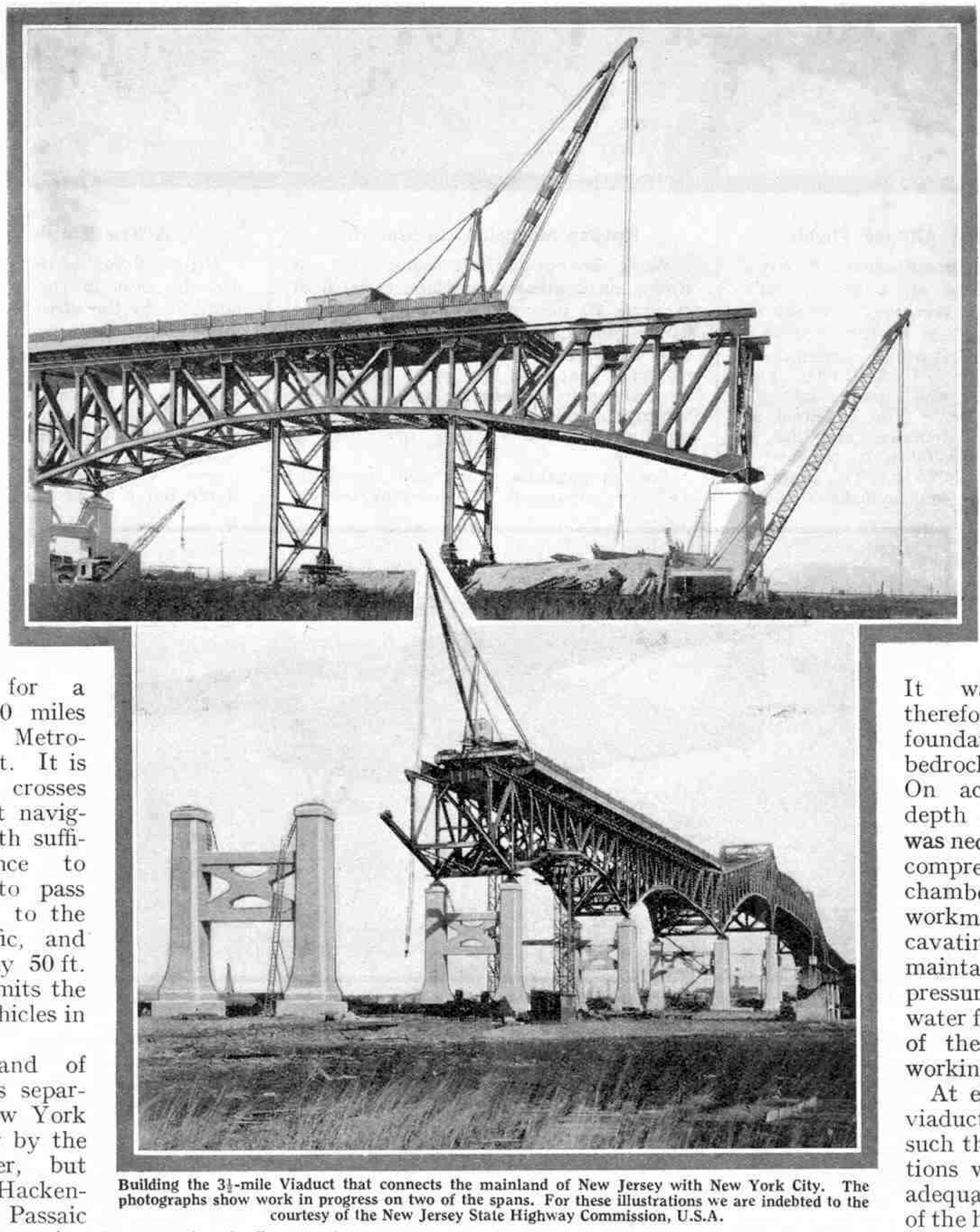
The appearance of a white flag outside Jerusalem next morning was not unexpected, and Major General Shea, acting on instructions received from General Allenby, approached the city. He was met outside the city wall by the acting Mayor and the Chief of the Police of Jerusalem, who surrendered the city to him. Two days later General Allenby made his official entry into Jerusalem.

General Allenby's capture of Jerusalem was in marked contrast to many previous attacks, for it was so planned and carried out that not a single shot was fired into the city. The victory was not won without cost, however, and the beautiful War Cemetery at Jerusalem contains the graves of over 2,500 men who fell during the fighting. The identity of many of the fallen is unknown, and in such cases the headstones bear an inscription to the effect that the buried hero is not forgotten. The cemetery, a part of which is shown in our illustration, was officially opened by Lord Allenby in May, 1927. In the centre of the long wall that forms the north east boundary is the Memorial Chapel, which occupies the highest point of the cemetery. It rises 36 ft. from a raised stone platform, and on either side of it are curved walls 15 ft. high, with stone panels bearing the names of the dead.

An Interesting American Viaduct

Crosses Two Navigable Rivers in $3\frac{1}{2}$ Miles

THE accompanying illustrations show constructional work in progress on the viaduct between Jersey City and Newark, U.S.A., which was opened for traffic towards the close of 1932. This viaduct forms part of a highway that is free from cause for traffic interruption for a distance of 10 miles through the Metropolitan district. It is $3\frac{1}{2}$ miles long, crosses two important navigable rivers with sufficient clearance to allow boats to pass without delay to the highway traffic, and has a roadway 50 ft. wide that permits the free flow of vehicles in four lines.



Building the $3\frac{1}{2}$-mile Viaduct that connects the mainland of New Jersey with New York City. The photographs show work in progress on two of the spans. For these illustrations we are indebted to the courtesy of the New Jersey State Highway Commission, U.S.A.

The mainland of New Jersey is separated from New York City, not only by the Hudson River, but also by the Hackensack and Passaic Rivers, and the peninsula on which is Jersey City. Before the construction of this viaduct only two roads connected this mainland with the lower part of the Island of Manhattan, by way of the Holland Tunnel for vehicles. The roads cross the Hackensack and Passaic Rivers on movable bridges that must be opened to permit boats to pass. Development on each of these rivers had reached the stage when interruption to highway traffic from the opening of the bridges caused a great deal of delay and consequent irritation.

At the river crossings it was necessary that the bridge work should be at least 135 ft. above the water level, and on account of this great height, and because the rivers are only a mile apart, it was decided that the viaduct between the rivers should be maintained at a high level. The soil near the rivers was a very soft wet silt, which did not permit the construction on it of foundations. It was necessary, therefore, to set the foundations on the bedrock below the silt. On account of the depth of the rock it was necessary to apply compressed air to the chamber in which the workmen were excavating, the air being maintained at such a pressure as to prevent water from flowing out of the silt into the working chamber.

At each end of the viaduct the soil was such that pile foundations were considered adequate. On account of the high cost of each of these foundations it was desired to use as few of them as possible. The use of long steel spans is more costly than the use of shorter ones, however, and in this case it was determined that a spacing of about 300 ft. between the piers was desirable. At the river crossings, on the other hand, a spacing of 550 ft. was required to prevent interference to the passage of boats in the river channel. Here it was desirable to have the roadway as low as possible, so the steelwork rises up on each side of the highway. The construction included the use of 230,000 cu. yds. of concrete, 88,000 tons of steel, and 250,000 lineal feet of piling.

Record Russian Altitude Flights

A short time ago three Russian balloonists succeeded in setting up a new world's altitude record by reaching a height of 19 km., equal to about 62,320 ft. or 11.8 miles. Prof. Piccard, it will be remembered, attained a height of 53,151 ft. The Russian attempt was made in the "*Stratostat U.S.S.R.*" The envelope of this is 118 ft. in diameter and has a capacity of about 859,700 cu. ft., the weight being only about 2,095 lb. The gondola of the balloon took four months to build and was made of 12 sheets of a special aluminium alloy, each sheet being 2 mm. in thickness. These were joined together by rivets of the same material, and were laid over skeleton tubes also made of the same material, but strengthened with brackets of steel. Five thousand rivets were used in the construction. The gondola is provided with two openings for entry and exit, and has nine inspection holes for navigation and observation, each being 100 mm. in diameter and covered with specially prepared glass. A shock-absorbing floor is fitted inside for the comfort of the occupants. Most of the apparatus is automatically operated, the altimeter, for instance, being in a hermetically sealed box connected to the outside air by means of a tube that goes right through the skin.

A more recent flight, in a balloon named the "*Osoviakhim No. 1*," did not end so successfully, for during the descent the gondola broke away from the envelope and fell to the ground, killing the three occupants. Some of the instruments and records were still intact, however, and from these it has been possible to estimate that the balloon reached a record height of 22 km., which is 67,580 ft., or approximately 13½ miles. Much valuable information has been obtained from the records, which state that as the balloon rose the sky appeared to change colour gradually, and that when the maximum height was reached it looked black-grey.

Russian Monoplane to Seat 70

Work is approaching completion in Russia on a giant monoplane capable of carrying 70 people, and to be equipped with engines developing between 5,000 h.p. and 6,000 h.p. It is a dual purpose machine that can be employed either to transport passengers and goods or for propaganda work, and is easily and rapidly convertible from one use to the other.

For propaganda work the aeroplane will be arranged to accommodate a large crew that will include shorthand-typists and wireless telephone operators. Special speech-amplifying apparatus will be provided so that talks can be transmitted either by loudspeaker or by radio while the machine is in flight, and it is hoped eventually to install a television transmitter so that it will be possible to broadcast pictures of the country that is being flown over. A printing press is to be built in the machine, and also powerful projectors to throw messages or pictures on to clouds so that they can be seen by the population over a very large area. If there are no clouds, they will be made by special artificial smoke apparatus.

The aeroplane is to carry a cinematograph apparatus for use when on the ground, the screen provided being large enough to be seen by 10,000 people. Current for this apparatus, and for all purposes when the machine is in flight, will be provided by a 9 kW electric plant installed in a special cabin. The crew's quarters will include sleeping and mess rooms, and a library.

The D.H. "Puss Moth" light high wing cabin monoplane, which is being replaced by the "Leopard Moth," a slightly more powerful three-seater. Photograph by courtesy of the De Havilland Aircraft Co. Ltd.

A New British Flying Boat

British flying boats, like British ships, are the best in the world. The latest addition to the already large number of flying boats built in this country is the Saro 24–31, an all-metal military machine with two Bristol "Pegasus" engines mounted in nacelles attached to the underside of the upper wing, one on each side of the hull. The sides of the hull are corrugated and are flat, making the interior very roomy, a necessary feature if the living accommodation provided for the crew is to be comfortable. The pilot's compartment is in the front and is totally enclosed. No performance details can yet be published as the boat is on the Air Ministry Secret List, but the makers state that it is more than eight tons in all-up weight.

The new boat is made by Saunders-Roe Ltd., of East Cowes, in the Isle of Wight. The best-known machines produced by this firm are the "Cloud," the "Windhover," and the "Cutty Sark," three monoplane boat seaplanes that are identical except in size. They are available either as flying boats, or as amphibians fitted with retractable landing gear that enables them to alight either on land or water.

A New 6-Cylinder In-Line Engine

A new air-cooled engine that is known as the "Gipsy Six," and is of the six-cylinder in-line inverted type, has been developed by the De Havilland Aircraft Co. Ltd. It develops 205 h.p. at 2,050 r.p.m. and is only 432 lb. in weight, the weight-power ratio being the remarkably low one of 2.11 lb. horse-power. An interesting feature of the engine is that, although it has two more cylinders than the "Gipsy Major," it is only 6 in. longer than the smaller engine. The cylinders of the new engine have a bore of 4.646 in., a stroke of 5.512 in., and a capacity of 9.186 cc. The engine consumes .55 pints of fuel per h.p. hour, which is equivalent to 15 gallons per hour at full throttle.

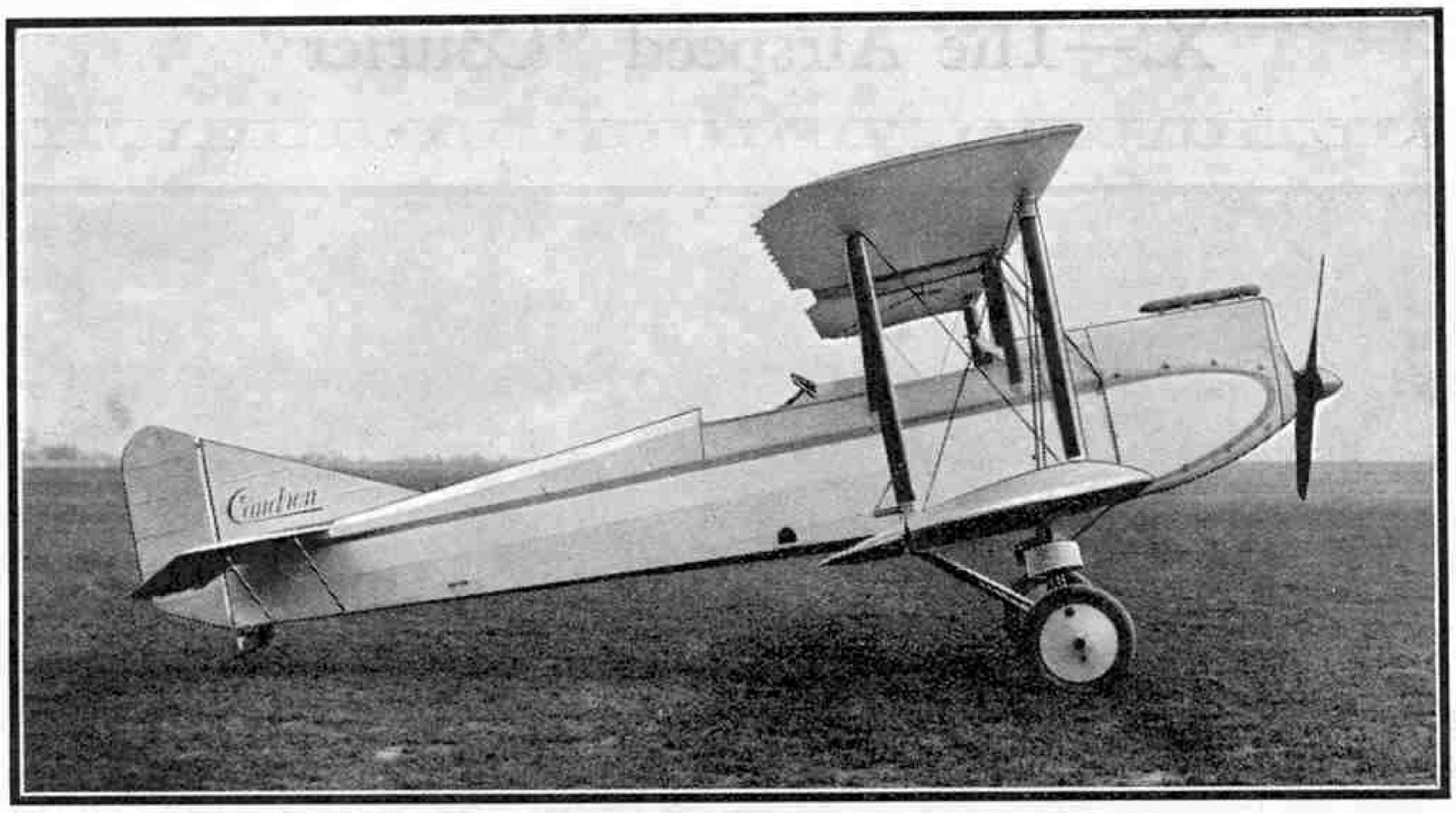
The "Merchant Skippers" of the Air

Years ago the favourite figures of romance for small boys were engine-drivers and ships' captains. The modern boy favours the aeroplane pilot, however, and particularly those men who pilot the machines on the long-distance air line services, for they fly in all weathers and over many countries. The pilots employed by Imperial Airways are the most experienced in the world, and eight of the senior ones have between them spent 66,000 hours in the air, equal to 2,750 days, or more than 7½ years! These airmen are Capts. Dismore, Horsey, Jones, Perry, Rogers, Walters, Wilcox and Youell.

Capt. O. P. Jones holds the record, for he has spent 9,806 hours flying. Capt. Jones has a very fine beard, and this has earned him the nickname of "The Captain Kettle of the Air." Capt. H. J. Horsey, whose photograph was published in Page 435 of our issue for June, 1932, has flown for 9,185 hours and is an expert pilot of flying boats as well as of big multi-engined landplanes. Capt. Youell has been keen upon flying from his boyhood, and he was actually apprenticed at one of the early flying schools, learning to pilot an aeroplane when he was only 16 years of age. During the War he was in the R.F.C. in France, and his figures for time spent in the air have now reached a total of 8,600 hours.

Capt. W. Rogers, after seeing war service with several squadrons of the R.A.F., became an air line pilot in 1920, flying the twin-engined machines that were the forerunners of the giant four-engined aircraft of to-day. His time in the air now stands at 8,144 hours. Capt. Wilcox, who started regular flying on the cross-Channel commercial air lines in November, 1919, has completed a total of 8,081 hours. He flew for 580 hours in the R.A.F. during the War, and afterwards was one of the pilots on an air mail service between Folkestone and Cologne.

Capt. H. H. Perry, who gained considerable experience as a pilot in the early days of civil aviation, joined Imperial Airways in 1927, and has flown for a total of 7,760 hours; while Capt. F. Dismore, whose figures stand at 7,475 flying hours, gained his pilot's certificate as far back as 1913, and has been flying ever since. Capt. L. A. Walters' flying hours now total 7,250.



The Caudron light aeroplane, one of the best-known light aeroplanes in France.

Height Indications by Lights

Coloured lights have been adapted to aviation in a radio echo altimeter that has been developed by Dr. E. F. W. Alexanderson of the General Electric Company of New York. The lights, which are mounted on the instrument board in the cockpit, give an actual visual warning of the height of the machine above the ground. When a green light flashes the pilot knows that he is 250 ft. or more above the ground; a yellow light indicates a height of 100 ft., and a red one gives a warning that the ground is only 50 ft. below.

The apparatus works on the well-known theory that the time interval required for a radio signal to travel from an aeroplane to the ground and back again to a receiving set in the aeroplane gives a reliable indication of the height of the machine above the ground immediately below. Thus it is particularly valuable in mountainous country, where an ordinary barometric altimeter is useless unless the pilot knows his exact whereabouts and can follow his course on a large-scale map, as it only gives his height above sea level. The Alexanderson altimeter gives altitudes up to 3,000 ft. but lamps are provided only in the lower part of the scale.

This photograph shows a side view of the Blackburn Civil Biplane, about which we hope to publish an article in an early issue. Photograph by courtesy of the Blackburn Aeroplane and Motor Co. Ltd.

Liverpool Airport Developments

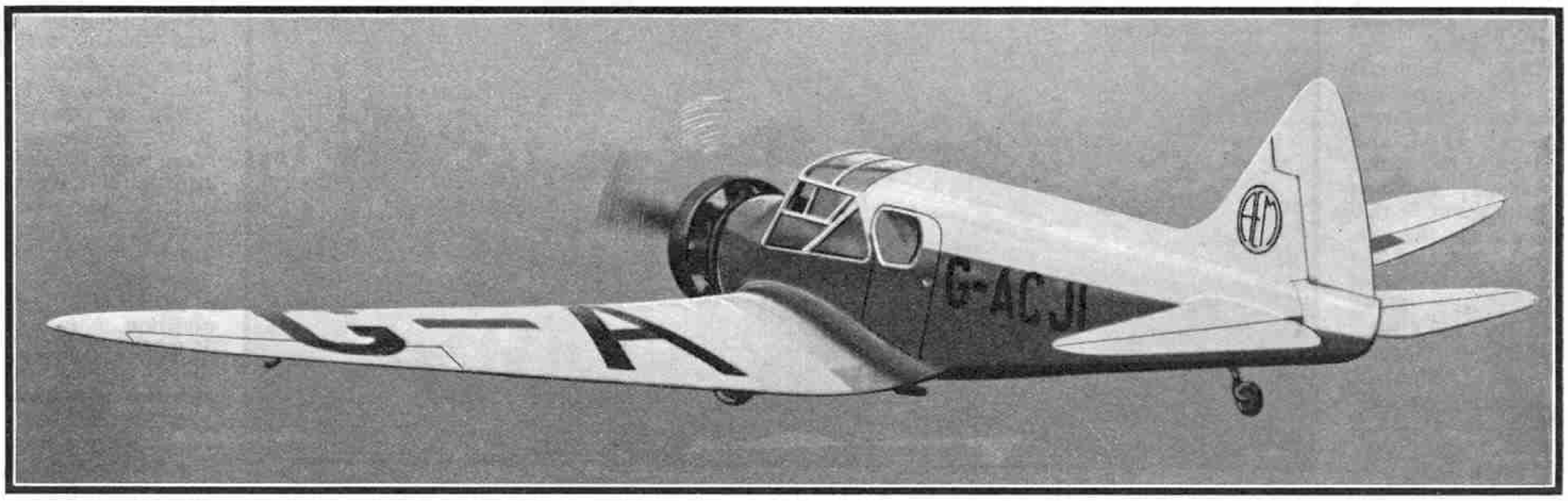
Preliminary reports of internal air line services that it is hoped to start this year indicate that Liverpool's municipal airport at Speke is rapidly becoming an important centre. As most of our readers will be aware, this aerodrome was opened in July last year, and during the rest of the season was kept very busy. Services were run from Speke to Blackpool, the Isle of Man, and Ireland and it is almost certain that this summer these services will be operated again every day. In addition, the K.L.M. or Royal Dutch Airlines service between Amsterdam and Hull, which was mentioned on page 24 of our issue for January last, is to be extended to Liverpool. It is to start on 1st June, and will be flown each way every day. A contract for the carriage of mails has been secured, and arrangements have been made for connections with other mail services at Amsterdam, to enable letters from Liverpool to be carried on to Scandinavia and Central Europe with the least possible delay.

Another service that will make use of Liverpool is one between London and Belfast that is to be operated by Midland and Scottish Air Ferries Ltd. Machines on the service will stop at Birmingham, Manchester, Liverpool, Hooton for Birkenhead, and the Isle of Man. A return journey will be made twice each day, and connections will be made at Liverpool with a "feeder" line from Glasgow, and in the case of the morning machine, at Croydon with the 12.30 p.m. Paris service of Imperial Airways. Midland and Scottish Air Ferries Ltd. at present have a fleet of 16 aeroplanes, but in order to cope with the extra work expected, five more air liners are being added.

Arrangements are being made also for a new service in Ireland between Dublin, Waterford, Cork and Limerick. According to present arrangements this is to be available for passengers and goods and is to be flown twice a day, and it is hoped that eventually it will be extended either to Liverpool or to Manchester. Three-engined Junkers machines are to be employed for the regular service flights, and several light aeroplanes are being purchased for special charter work, a very popular branch of the company's activities.

British Aircraft Developments

X.—The Airspeed "Courier"



The photograph above shows the Airspeed "Courier" in flight, with the wheels retracted. The illustrations to this article are published by courtesy of Airspeed Ltd.

IN this country we have been very slow in developing passenger machines of medium size capable of cruising at comparatively high speeds. We have, of course, the best flying boats and light aeroplanes in the world, and we can hold our own in the realm of what are usually termed "air liners." Until recently, however, there have been no British single-engined high-speed cabin aeroplanes capable of carrying six or seven people, and therefore there can be no question that the Airspeed "Courier," which is of this type, is an important development in civil aviation in England.

The need for a machine of this type is obvious. Throughout the world there is a continuously increasing demand for higher speed in air transport, and this is particularly felt in regions like the British Isles, where aircraft operators are finding that, to compete with first-class ground transport, higher speeds are necessary to counteract the delays that may occur on aerodromes, and almost always do occur in transporting passengers from the aerodrome into the cities that they serve. In addition, a high-speed machine makes it possible for more journeys to be completed in a given time, which results in economy as it enables the operator's fleet to do more work and therefore to be kept as small as possible.

Fast aeroplanes have been available of course during the past few years, but they have usually carried less pay-load per horse power than the slower types, and often have had other disadvantages, such as a fairly high stalling speed. In such cases the operating cost per passenger mile is so high that it outweighs the advantage of completing more trips in a given time; while the safety factor, which is the most important question where passengers are concerned, is reduced. For these reasons, and because of the necessity to economise owing to the comparatively small use that is made of air travel, the slower types have been selected.

In the "Courier" the makers claim to have produced a fast passenger-carrying aeroplane that is at the same time economical in running cost per passenger mile. This feature has been obtained by the use of a specially-designed undercarriage that may be lifted up, or retracted, when the machine is in flight, and tucked away in the wing as a bird folds back its legs when it is in the air. This eliminates the drag that is set up by a normal undercarriage, which is surprisingly high, and it enables an increase in cruising speed to be obtained from the same expenditure of power per passenger.

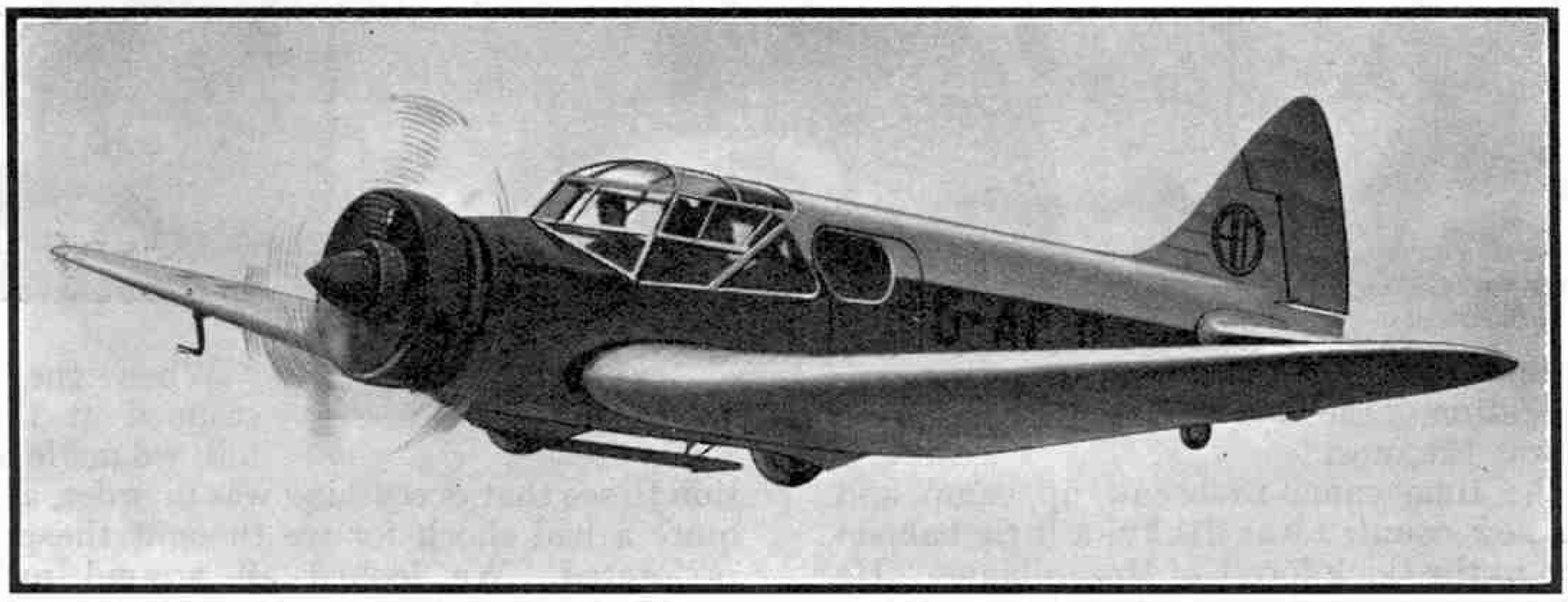
The "Courier" is fundamentally a long-range passenger-carrying aeroplane, providing accommodation for one pilot and five passengers, with a generous allowance for luggage. The occupants are seated in three pairs, and if required dual controls can be fitted for the passenger accommodated alongside the pilot. With this load the machine carries fuel for five hours, or 700 miles at a cruising speed of 143 m.p.h.; but extra fuel tanks to give a longer range may be fitted. The "Courier" is a low wing monoplane with a tapered cantilever wing 47 ft. in overall span and divided into three parts. The centre section, which has a span of 10 ft. 2 in., is permanently attached to the fuselage, and carries two extension planes secured to the centre section by two vertical bolts that pass through the front and rear spars. Special quick release attachments are provided for the aileron controls and for the air speed indicator connection, and thus the extension planes can be quickly and easily detached when necessary, to house the machine or for any other purpose.

The wing is constructed entirely of wood and is built round two spars made of spruce, carrying normal ribs. The method of construction and bracing employed makes a wing structure that is extremely stiff in torsion, or in other words is very difficult to twist; and consequently it is capable of resisting flutter or deflection even when the aeroplane is travelling at very high speeds. The ailerons are mounted on the extension planes and are of the "Frise" balanced type, which means that they are not hinged right at the front or leading edge, but have a hinge a little way behind it to give a balancing effect when the aileron is moved. This lessens the force required to operate the ailerons when flying at speed, and consequently makes for ease in control and greatly reduces the tiredness experienced by a pilot on a long flight.

The fuselage, which is 28 ft. 6 in. in overall length, is, like the wing, in three sections. The front section is integral, or in one piece, with the engine mounting, and is built up of welded steel, thus providing maximum protection for the occupants of the machine in the event of a crash. The rear and centre sections are of semi-monocoque construction and have spruce longerons and special stiffeners covered with birch three-ply. The fuselage has been designed so that it is easy to repair, even in the most remote districts where skilled labour and properly equipped workshops are not available.

The centre section of the fuselage carries the cabin, which is 8 ft. long, 3 ft. 10 in. wide and 5 ft. 3 in. high, and is thus large enough to allow of comfortable seating arrangements for six people. The machine can be supplied also as a four-seater. The cabin then can be made really luxurious, and in this form the machine becomes an admirable one for the private owner who desires fast and comfortable travel, whether piloting himself or employing a professional pilot. Access to the cabin is by a large door on the port side of the fuselage, and this is arranged near the ground so that there is no more difficulty in getting in and out than there is in stepping in and out of a saloon car or a railway carriage.

The bearings of all the flying controls are fitted with ball races. Normal stick control is used for ailerons and elevators, but the directional control is by means of rudder pedals positively connected to the rudder by gears. When the machine was being designed great attention was paid to making the empennage surfaces particularly robust and stiff. The tailplane is therefore of full cantilever construction, while the fin and rudder are designed so that it is possible to maintain straight flight for long periods with feet off the rudder pedals, whether the engine is either on or off.



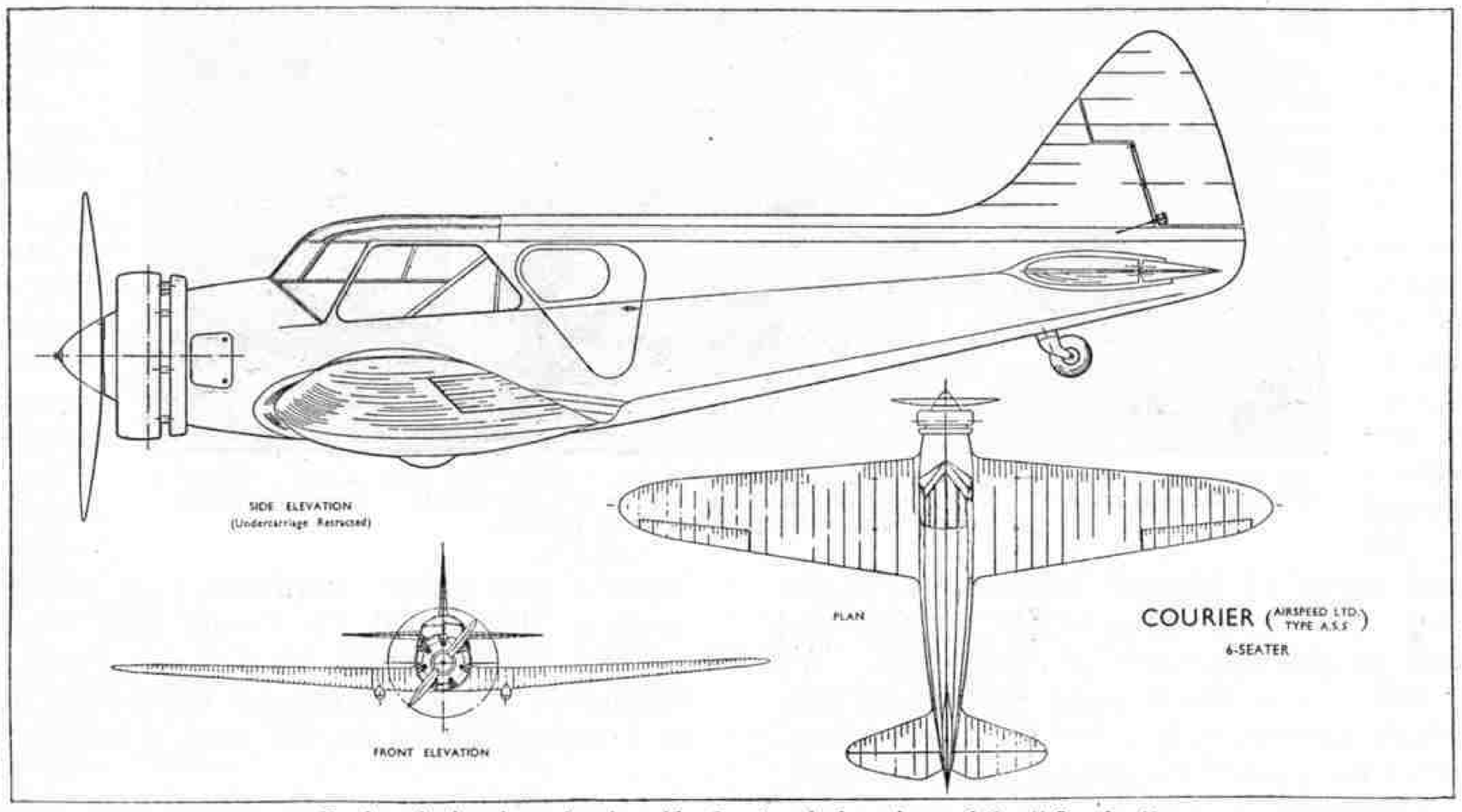
A three-quarter front view of the "Courier" showing the small amount of wheel protruding below the wing. The machine will alight safely on this if the pilot forgets to let down the wheels before landing.

The most unusual feature of the "Courier" is the retractable undercarriage, which is of a special patented design that has been developed by Airspeed Ltd. This apparatus makes it possible for the wheels to be drawn up into the wings in nine seconds when the machine is in flight, and for them to be dropped into landing position in three seconds. The undercarriage is provided with Vickers Oleo-pneumatic shock-absorber struts of a type that has proved very efficient in service in many other machines, and possesses the great advantage of requiring little attention over long periods. These struts support Dunlop wheels of robust design capable of standing up to heavy duties, and fitted with brakes operated from the pilot's cockpit. A normal "split" axle joins the wheels to the fuselage and the two struts making it up are hinged both to the wheels and to the fuselage. Two other struts, known as "radius rods," are hinged to the bottom of the Oleo-pneumatic legs and to the fuselage behind, and these are jointed in the middle. Just above the joint of one is a ram from a hydraulic cylinder, arranged so that when it is drawn in the radius rod "breaks" in an upward direction, lifting the wheels, axle and shock absorber legs into the recesses provided for them in the underside of the plane.

As soon as a pilot has taken off and wishes to retract the undercarriage, he moves a three-way cock on a hydraulic pump situated between the two front seats, until it is pointing to the "up" position, and then works the handle. This causes oil to be pumped from one side of the piston in the cylinder to the other, which moves the piston and the ram connected to it, breaks the radius rod, and retracts the undercarriage, which remains up until the cock is moved to the "down" position and pumped. The undercarriage is secured in either position by moving the cock into the central or "lock" position.

When the undercarriage is fully retracted, one third of the diameter of the wheels remains protruding below the lower surfaces of the plane. In this position the wheels are capable of rotating freely, and are quite able to support the weight of the aeroplane. Thus if the pilot forgot to put down his undercarriage before landing, the machine would alight on the exposed portion of the wheels and, though slight damage would be unavoidable, it is unlikely that any serious structural breakage would occur. In any case the passengers should not suffer injury. To lessen the slight risk of such forgetfulness on the part of the pilot, however, an electrical warning system is incorporated to indicate the position of the undercarriage by means of a system of lights placed on the dashboard. These lights can be switched on whenever required by pressing a button, but in any case are automatically lighted as soon as the throttle is closed for the machine to glide to land. If then the pilot still omits to put down his undercarriage, a high-frequency horn comes into operation to give him final notice. If he still forgets he deserves to lose his licence!

It is of course possible to start the engine of the "Courier" by "swinging" the propeller by hand, but this course is not recommended, and a starting magneto and a special doping pump are provided as standard equipment. In starting up by these means the engine is turned over several times by hand while mixture is injected into the inlet pipe by the doping pump, after which the starting magneto is turned and the engine should fire right away. This system is employed in the R.A.F. for engines similar to that fitted in the "Courier," and it provides an almost effortless start. If desired, however, an Armstrong-Siddeley electric starter can be fitted at extra cost. This system makes it possible to start an aeroplane in a similar manner to a car, the pilot sitting in his seat and pressing a button, when the engine starts up immediately.



Engineer's drawings showing side, front and plan views of the "Courier."

The "Courier" is 2,210 lb. in tare weight and may be loaded until the all-up weight is 3,900 lb. In this condition it has a maximum speed at sea level of 162 m.p.h., is capable of cruising at 143 m.p.h. and lands at 55 m.p.h. When the machine is fitted with the two normal fuel tanks, which are each of 28 gallon capacity and are mounted in the centre section plane on each side of the fuselage, it has a range at cruising speed of 700 miles. An extra tank may be fitted, however, and this brings the range up to 840 miles. The petrol from this tank is fed to the engine by gravity, but that from the two normal tanks is fed by pumps driven by the engine.

The figures given above are for the type powered by the 215 h.p. Armstrong Siddeley "Lynx" engine. Another version, using the 275 h.p. Armstrong Siddeley "Cheetah" engine, has a maximum speed of 165 m.p.h., a cruising speed of 150 m.p.h., a landing speed of 59 m.p.h., and a maximum range in still air of 600 miles.

The cost of the "Lynx"-engined "Courier" is £3,200, while the version that uses the more powerful engine costs £3,450.

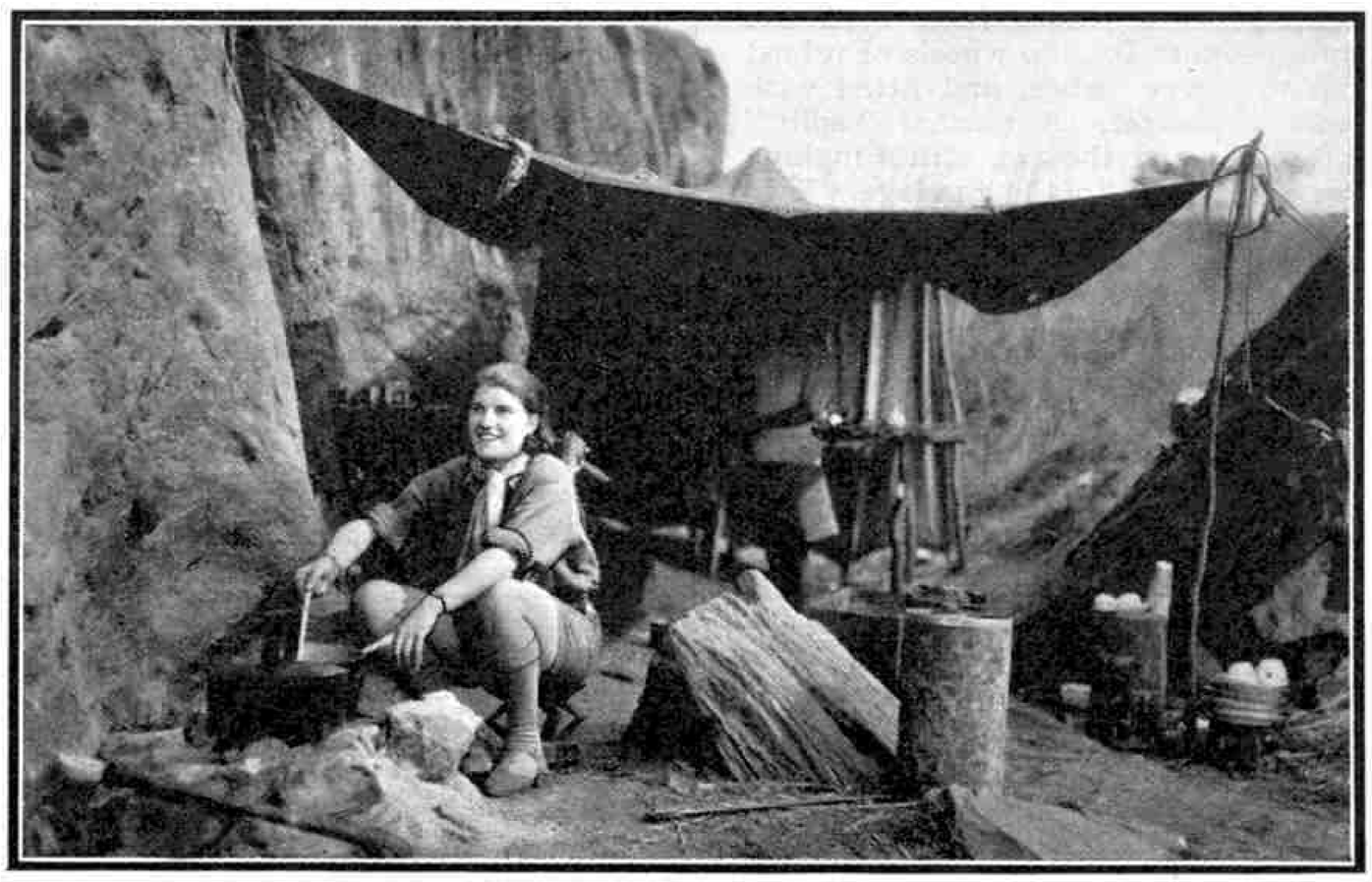
Pets of an African Camp

By Commander Attilio Gatti

OF all the members of my last expedition, the one who was the most pleased when the time came to break up camp and journey on to a new country was Tikky, a little baboon we had captured in the thick forest of Mozambique. He was, when we found him, a little bald, wrinkled fellow about the size of a closed fist, a savage, shy and suspicious baby, defying the world as best he could. From that time he accompanied us faithfully and joyously through all our adventures, especially happy when we moved from one place to another, for motoring had become his passion, a fact contrary to our every expectation, as his first experience had been a disaster.

Only two days after we captured him we had continued our trip and Tikky was placed on the roof of the truck. Poor little beggar, that affair of moving through the forest while he himself remained stationary was not at all to his taste. It was against every law of nature that he had learned in his short life. He flattened out and attached himself desperately to the roof with his four hands, looking wildly around and ducking nervously at the approach of every tree. We couldn't blame him, for it must have seemed to him that the whole forest was suddenly marching against him.

A few hours after we started the brakes failed to work, and the truck commenced to roll crazily down a steep hill. The natives began to shout and jump from the truck, the speed was continuously increasing, and I think poor Tikky lost his head. Frightened out of his senses, and at the same time furiously resentful of his unkind fate, he abandoned his flattened position and went into a frantic war dance on his four legs until, at an unusually large bump, the roof disappeared beneath him, and he found himself dangling in the air attached to a rope too long to permit him to climb back on the roof, and too short to allow him to reach the ground.



The photographs in the heading are (left) Commander Gatti and "Tikky," the baby baboon; (centre) a leopard, a dangerous pet; (right) a lion cub, and a pet monkey of a rare variety. Lower photograph: Expert work in the primitive camp kitchen.

When the truck finally stopped at the foot of the hill, we made a quick inspection to see that everything was in order, and then we had quite a bad shock for we thought the petrol tank was perforated. We looked all around until we finally discovered poor Tikky, more dead than alive, hanging with his head down and giving free rein to his indignation.

Gradually he became accustomed to the motion of the motor car, and grew to be an ardent enthusiast. As soon as he saw us starting our preparations to take down the camp he would become wild with joy, commence to jump crazily in the air, and to bite the rope with which he was tied with such energy and craftsmanship that he was soon free. Then in two leaps he would reach his place on the roof of the truck, and there sit quietly amusing himself by watching us as we worked like mad in folding tents, closing bags, and searching for the material our boys always forgot.

As soon as the engine started he would begin his famous war dance, until the first jolt of the truck in motion threatened to throw him overboard. Then, perhaps remembering his first adventure, he would run to huddle down between my knees, as I always travelled in a seat arranged on the roof, a wonderful observation post.

During the whole run, sometimes quite monotonous, his buffooneries, the naughty little tricks he made now and then, and the pitiful glances with which he afterwards asked to be forgiven, were my best distraction.

Dangerous, ugly, or ferocious as some of them may become once they are fully grown, while they are still young all the animals of the veldt are extremely interesting, often very amusing and sometimes delightfully graceful. As soon as a difficult hunt or a long scientific research keeps us encamped in one vicinity for any length of time, youngsters of every possible variety and specie begin to make their appearance.

Sometimes we capture our little visitors ourselves, when their small legs prove unequal to the task of keeping pace with the mother who has run away at our approach. But often the natives bring them to us, only too happy to exchange a small beast or bird for a handful of salt or a piece of cloth. A gazelle just born, perched in difficult equilibrium on the top of four long legs, rigid and stiff as toothpicks, or the soft fluff of a baby night ape from which emerge only two enormous green eyes above a sharp little nose, and four paws like tiny flattened hands. Poor little creatures! They tremble with fright in all their being, but their tremors disappear at the first caresses and the first tempting morsels of food, and they are soon frisking about the camp, confident and fearless and full of devotion to their new human friends.

(Top, left) A night-ape, or "bush-baby." (Top, right) "Tikky." (Centre) Storks—a study in bills. (Bottom, left) A baby gazelle. (Bottom, right) A first venture on four long legs.

At other times we have youngsters of a different type. A small leopard or lion cub, full of the grace of a kitten, but already supplied with small pin-like teeth and sharp hooked claws that can do quite a bit of damage if one is not careful. Or aquatic birds that from birth possess enormous beaks, clumsy and ridiculous. As they grow older they seem to lose all control of their extraordinary appendages, and when they frolic together they appear to be in imminent danger of swallowing each other whole.

Then there is the ostrich. This ungainly bird from infancy seems to have the speciality of poking his stupid little head into every unlikely corner, and of consuming the most varied and unusual objects with the same indifference both to the hygiene of his stomach and to the surprise of anyone who may be watching him. This eccentric trait has many unfortunate results. A light-fingered native steals something? One of us loses some object or cannot remember where he left it? It may be some sugar or a "still" camera, a salami or an electric torch—the alibi is always ready for everybody and everything: "The ostrich has swallowed it." So between the crimes actually committed, and those attributed to him, the bird soon becomes a perfect public nuisance.

Sometimes a young elephant arrives. Normally a very good fellow of a serious and reflective character, he, poor chap, although young, is already so heavy and ponderous that in spite of all his good intentions he is forever making a tragedy. He is like some good honest peasant who goes to pay a visit to a distinguished friend in town. The more he tries to be delicate and full of regard, the more blunders he commits.

Soon these young creatures of species so diverse forget all the enmities, the rivalries and antipathies that from immemorial times have separated their families, and would have separated themselves had they been left to the savage liberty of the bush. And they become the best friends on earth. The pelican deigns to pose on the back of the elephant, who democratically consents to eat in common with the wart hog and the ostrich; while the monkey amuses himself in teasing the small leopard, and the gentle gazelle doesn't dare to move, so much she hates to disturb the night ape who is taking a nap between her legs.

At last the day comes when we must leave again and, since we cannot transport our little zoo for thousands of miles, we regretfully restore to our pets the liberty that probably they no longer want, or at least for which they never seem to yearn. And so we start toward new countries, new adventures, new work, taking with us only some small animal that can accommodate itself to our movements, and to which we are particularly attached.

Of all of these small animal friends, Tikky was easily the star, and crossed all Africa from Mozambique to Capetown, and thence to Cairo, as quite an important member of our expedition. He was really a good little rascal, having only the curiosity and the mischievousness of all children; and like every child all he wanted were caresses and tempting bits of food, and that some one of us would join him in his endless play. He could read accurately every expression of our eyes, our faces, our voices. If we were in a good humour he immediately took a chance from that fact to create every possible pandemonium, keeping up his exuberant mischief until we were exasperated. Then at once he became silent and quiet, looking at us with a pathetic and sad air, solemnly scratching his head, huddling down like a small statue of misery, and peeping up at us to see how we were reacting to his performance. At last we were compelled to laugh, and at our first change of expression he would jump in the air like a spring, grinning, dancing, chattering, and trying in every possible way to coax us into a game.

If we wanted to go ahead with any work we were obliged to send him away and have him tied up in the kitchen, where he at once became very dignified, for he placed no confidence in the natives and allowed them to take no liberties. When it was cool (Continued on page 340)

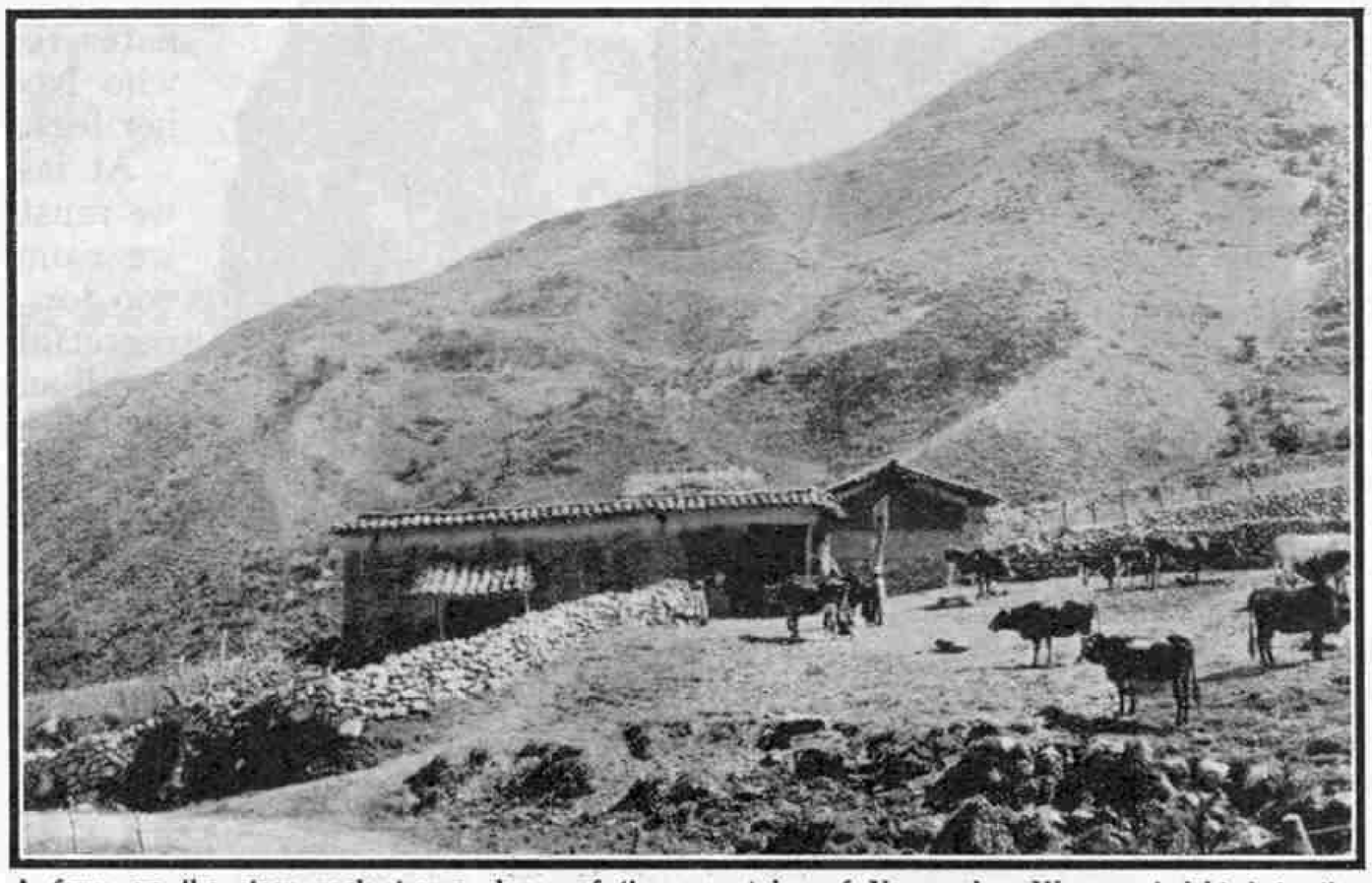
A Journey Into The Past

Living Trees Reveal Secrets of Prehistoric Forests

By Dr. Ralph W. Chaney

MILLIONS of years ago there lived in western North America a forest wholly unlike any now to be found there. The trees of this forest have long since disappeared, but prints of leaves have been left where they fell on the sand and mud that bordered the ancient streams and lakes. These fossil leaves, preserved in sediments that have hardened to solid rock, differ in appearance from those of the trees now living in California, Oregon and Washington. In general they are larger and thicker than the leaves of these modern trees, and they have more the aspect of the vegetation of the tropics than of living temperate species.

To the botanist who is concerned with fossil plants, and is a student of the history of plant life, there comes the problem of finding an existing forest whose trees have leaves similar to those of the prehistoric forests of the Pacific coast of the United States, and may be supposed to be living under conditions similar to those that prevailed before the ancient forest was fossilised. With its discovery there may be disclosed a page of the past history of the Earth—a picture of western America as it was before human eyes looked upon it—a forest that has lasted down through the ages to give us in these later years the thrill of venturing far back into the days of long ago.



A farm on the steep rock-strewn slopes of the mountains of Venezuela. We are indebted to the Carnegie Institution of Washington for our illustrations.

The search for a forest of this kind is travel that involves not only space but time—travel representing journeys to distant lands and to the still more distant ages before Man lived upon the Earth. It is comparatively simple to board a ship and in two weeks' time to cross an ocean; it is also possible during the two weeks to journey back over millions of years and to see the Earth as it was long ages ago. Such a trip into space and time began on 22nd December, 1931, when Dr. Erling Dorf and I, representing the Carnegie Institution of Washington, travelled southward from Boston aboard the Canadian National steamship "*Lady Hawkins.*" Our purpose in doing so was to explore the modern forests of British Guiana, Venezuela, Panama, Costa Rica, and Guatemala, and to carry out a brief survey of accessible vegetation on several islands in the British West Indies.

A dozen stops in the British West Indies gave views of the trees on these islands, where dark-skinned British subjects raise sugar cane and cocoanuts. The ship reached Georgetown, British Guiana, early in January, and a road under construction toward the great Kaieteur Fall furnished a means for crossing nearly one hundred miles of virgin forest. Interesting though this forest was, it had but little in common with the ancient vegetation of western North America, due no doubt to the fact that the climate in British Guiana is much more tropical than any that has existed in California or Oregon.

The aeroplanes of the Pan-American Airways were utilized from this point, and the journey around the coast of South America to Maracaibo was accomplished speedily and safely. This Venezuelan city represents the centre of the oil industry on the South American continent.

The trip by boat up Lake Maracaibo and by train into the foothills of the Andes is slow and tedious. Up over the mountains to a pass more than 14,000 ft. in elevation and down to the little town of Merida, the motor road passes through beautiful country—banana plantations and cane fields at the lower elevations, corn and beans higher up, and for the last several thousand feet to the summit the Indians plant wheat almost exclusively. The steep, rock-strewn slopes would discourage many farmers, but these mountain people working with the most primitive implements succeed in making a living in spite of their unfavourable surroundings.

A modern forest of Panama that contains many trees similar to those of which fossil remains are found in Western North America. Exploration of the depths of such forests reveals many secrets of plant life of the past.

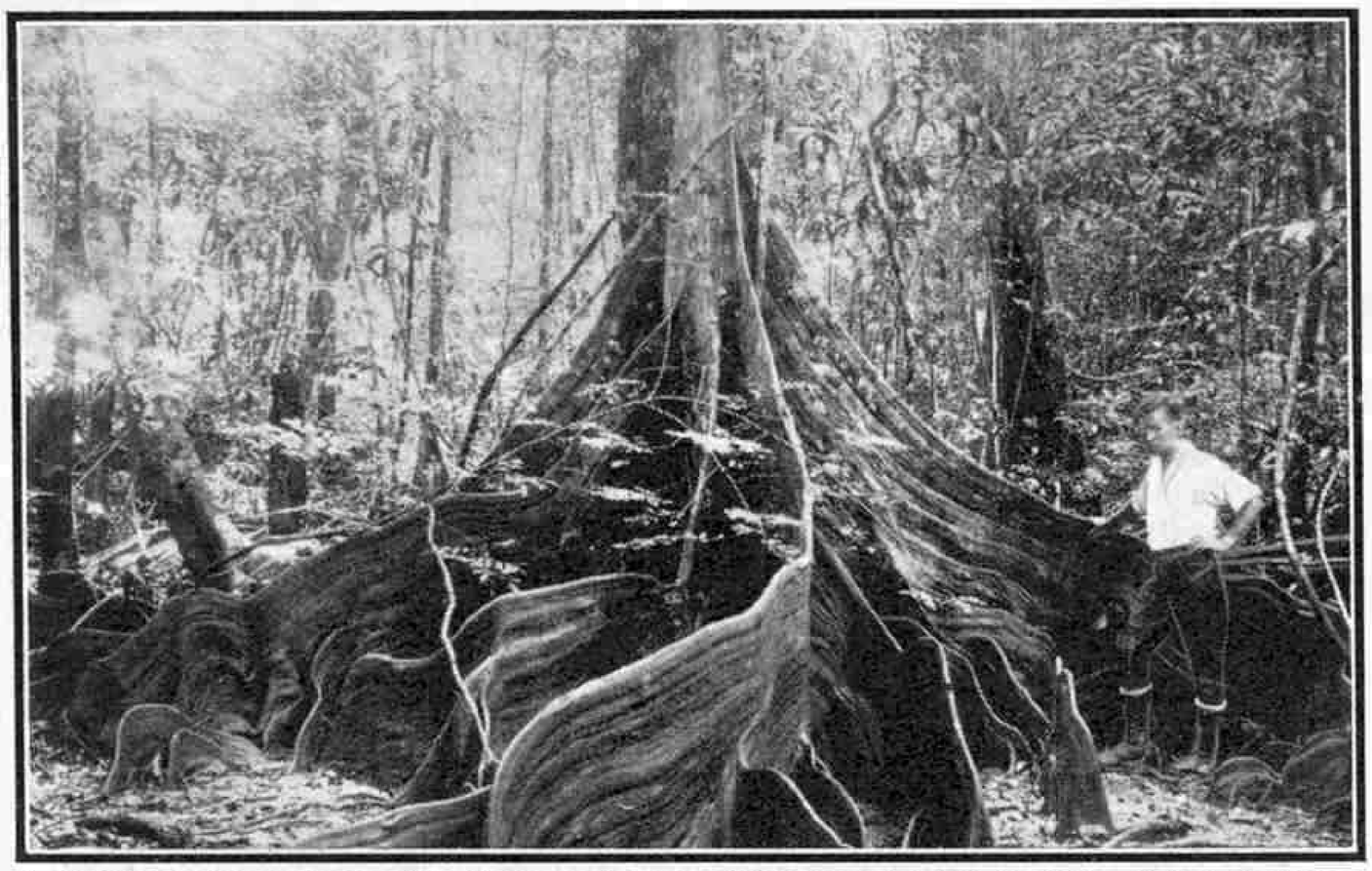
At such high elevations there is no suggestion of tropical warmth in the damp winds and foggy skies. The natives wear heavy ponchos when they ride or walk to market. Even at Merida, which lies far below the summit of this Andean pass, at an elevation of a mile above sea level, blankets are a necessity during the night, and permanent snow fields on the higher peaks surrounding this mountain town seem wholly out of place in a land so near the Equator.

Similarly, the forests on the slopes around Merida are unlike those growing in the tropical lowlands. Figs and palms remain, but with them are many temperate trees like those found to the north in Mexico and our southern states. When their leaves are compared with the fossil imprints in the rocks of western America, a close resemblance is at once apparent. Two thirds of the fossil species have close relatives in this temperate rain forest of Venezuela, and the student of earth history may conclude that a forest of like appearance, and with much the same climatic requirements, once extended far northward into Oregon.

Not only the trees but the animals of South and Central America

have at the present time a close similarity to those which once ranged into temperate latitudes. The tapir and the tree-sloth, which are to-day limited to forests near the Equator, have left a record of their former presence in North America—petrified bones that tell of their wanderings far to the north of their present home. The abundance of alligators and large lizards is suggestive of the Age of Reptiles, when dinosaurs were wide-spread as far north as Canada and Mongolia, as shown by the skeletons of these animals that are preserved in the rocks of that ancient day.

Forests and shores from the air envision much that cannot be seen from the ground. Long lines of coral reefs showing light blue where they approach the surface are marked by curving lines of foam where the waves break across them. The narrow row of mangroves along the shore is covered with swirling bits of white and patches of red, where herons and scarlet ibises fly up at the roar of the plane. From the forest top the rounded shapes of large trees rise like great cauliflowers, and the bright plumage of parrots and macaws flying over them vies in brilliance with the yellow, red and purple blossoms of a land where flowers are ever blooming.



A curious buttressed tree found in the tropical forests of Central and South America. This is unlike any tree that grows in the temperate zones.

If all scientific observations could be made from the air, tropical exploration would involve less perspiration and fewer tick bites. In practice, however, the preliminary view of the forest from above must be followed by a careful study of the vegetation and the topography from the ground. Here one's study of a strange leaf or a curious buttressed tree trunk must be shared with some attention to the progress of a tick engaged in exploration of his own. Snakes —harmless or poisonous—the bark of a wild pig, the brilliant plumage of a trogon, the march of army ants, all compete for the interest of the visitor from the North.

In the depths of this forest, screened alike from wind and sunshine by the dense canopy above, lie many of the secrets of the past, many of the explanations for conditions on the earth to-day, and suggestions even of what may be expected in the years that lie ahead. The tall oaks of the mountain forests in Central America, with a mixture of laurel and fig like that of the fossil floras, give a picture of the past that has endured down to the present in Costa Rica and Guatemala, a picture of California and Oregon as they may be once more if warm ocean currents and winds return to make more hospitable the northern borders of the Pacific.

Reconstructing the history of the Earth on the basis of the fossil floras of western America and their living equivalents in the mountain forests of Venezuela and Central America, a trend may be observed during past ages from a moist warm climate to the relatively dry and cool conditions of our day.

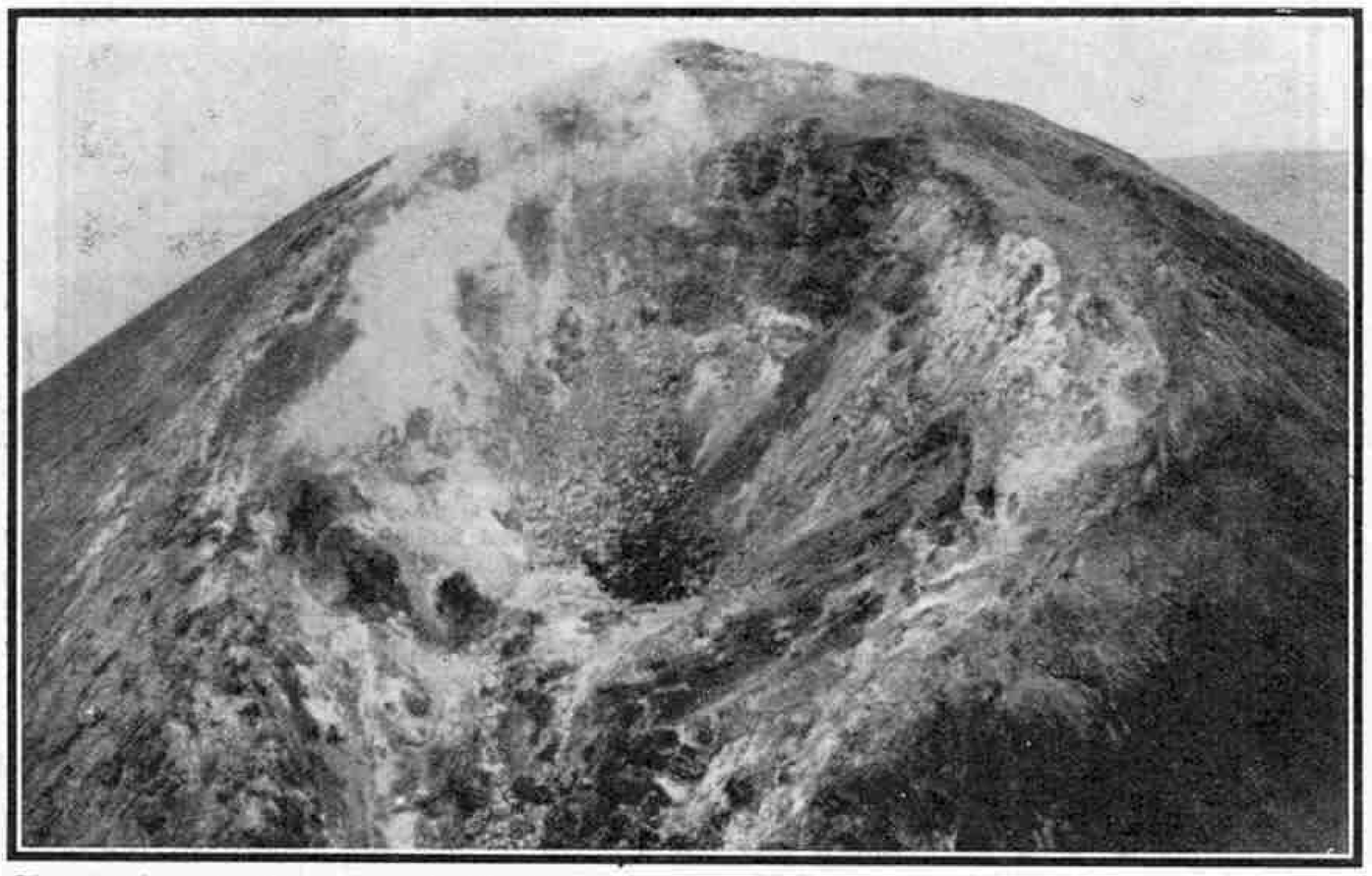
Just what were the causes of this gradual change is a difficult question to answer ; variations in the amount of heat given off by the sun or in the insulating power of the atmosphere, shifting in position of continental masses with a resultant alteration of currents of water and air—all these and many more factors may have contributed. The fact of this climatic change is fully demonstrated by the migration southward of the forests, and the animals that lived in them, to the only part of the world where suitable conditions of temperature and moisture still exist.

The human inhabitants of the plateaus and mountains in Central America also give evidence of participation in these great southward migrations.

The descendants of the Maya in Guatemala, Indian tribes that ruled all this country at the time of the coming of the Spaniards, show striking resemblances to the natives of North America and Asia. Their mode of living is wholly different from that of the Mongols of the Gobi Desert, who have a diet almost completely restricted to meat, due to the difficulty of raising crops in an arid region. The Central American Indians depend largely on corn, and its excellence as food is indicated by their robust health and appearance. But in appearance they are strikingly like the Mongols, and many details of mode of living suggest either their descent from a common stock or an interchange of ideas.

A long line of active volcanoes extending from Mexico through Central America and down into the Andes of South America gives further details for the picture of conditions on our Pacific Coast in the distant past.

Over thousands of square miles in southern Guatemala there fell on 21st January, 1932, a shower of volcanic dust that covered the ground, the roofs, and even the leaves of the forest with a thin mantle of grey. More active and prolonged eruptions have occurred here and in other parts of the world during recent years, deeply burying adjacent cities and forests.



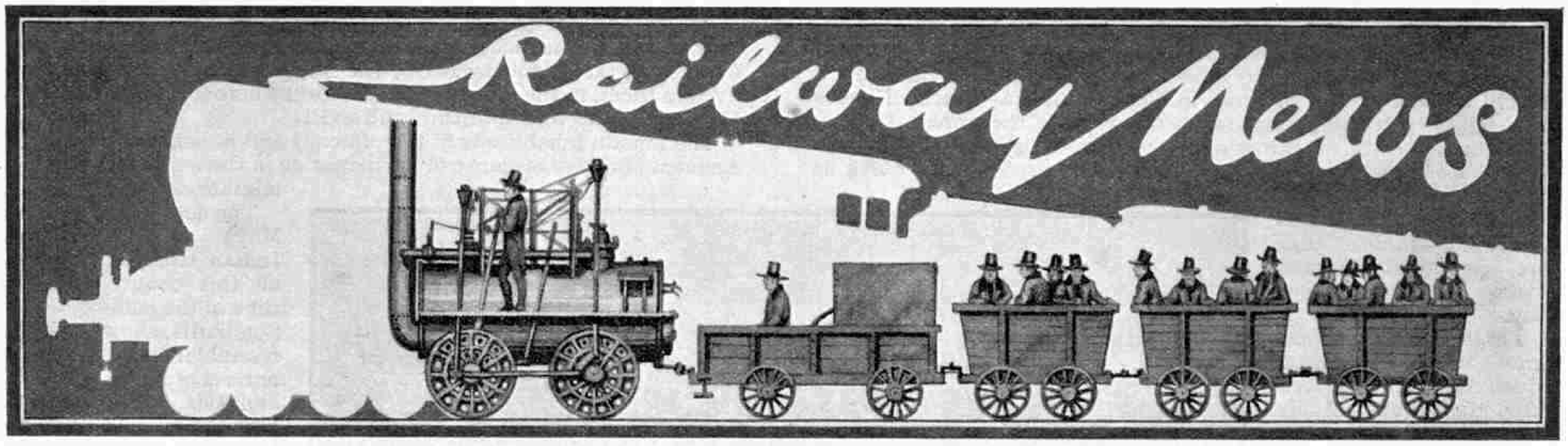
Momotombo, an active volcano in Nicaragua as seen from the air. Remains of plants and animals buried in solid rock formed from thick layers of sediment from the eruptions of ancient volcanoes in California aid the scientist in his efforts to reconstruct the life of the past.

Thick layers of volcanic sediment, now compacted into solid rock, are widespread on the borders of the Sierra Nevada in California and of the Cascades in Oregon. These layers represent the eruptions of ancient volcanoes which buried the landscapes of long ago in showers of dust. The remains of animals and plants entombed in the volcanic dust furnish the fossil record which is used by the palæontologist in reconstructing the life and living conditions of the past.

In western North America volcanic activity has largely subsided, and a gradual change in climate has resulted in the extinction of many types of plants and animals which were formerly widespread. To the south, volcanic activity has continued down to our day ; a hot moist climate has permitted certain plants and animals to linger on into the present. There we see our country as it used to be—volcanic peaks mantled by rain forests in which roam curious beasts.

Through tens of millions of years these portions of Central and South America have remained essentially unchanged, an early chapter which Man, a late-comer upon the Earth, may still read in the story of Earth history.

For permission to reproduce this article we are indebted to the courtesy of the Carnegie Institution of Washington.



L.M.S.R. "Pacifics" in Regular Service

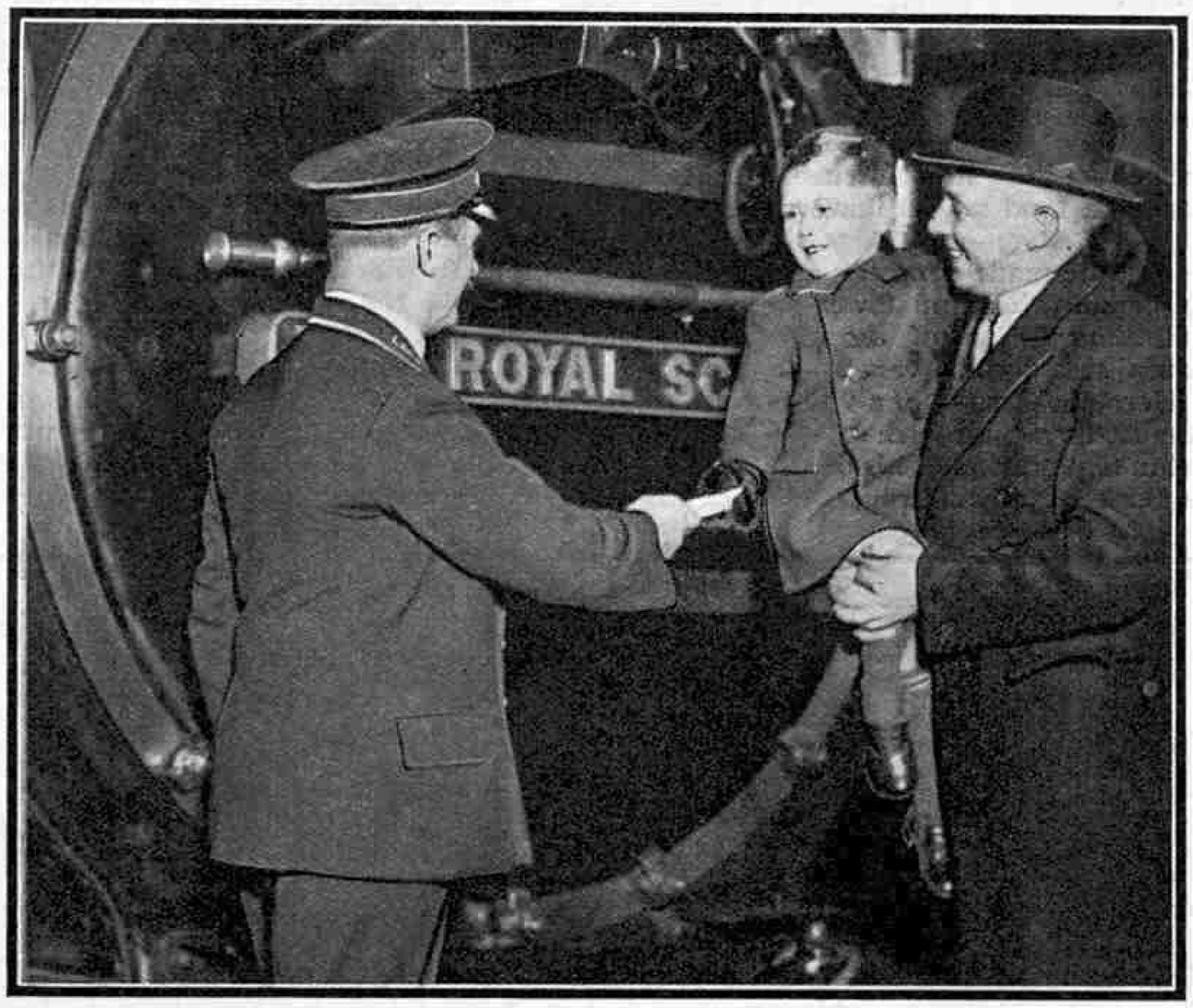
Several of the newest locomotives of the L.M.S.R. are now stationed in the London area. Of the 40 new "Moguls" with taper boilers, all of which have been put into service, 10 are located at Willesden for working the fast freight trains between London and the north. No. 2424, one of the latest 2–6–4 tank engines with "limousine" cabs has been allotted to the Watford depot. Another new engine of unusual interest that has recently been allocated to the Willesden depot is a six-coupled 250 h.p. Diesel-electric shunting locomotive constructed for the L.M.S.R. by Sir. W. G. Armstrong Whitworth and Co. Ltd. This engine, which bears the number 7408, is engaged experimentally on shunting duties at Brent Sidings, between Willesden and Wembley.

One of the "Garratt" locomotives, No. 4998, has undergone a series of tests in acting for a period as a banking engine on the steep Lickey incline between Bromsgrove and Blackwell. The purpose of this experiment was to ascertain the coal and water consumption of the "Garratt" engine in comparison with that of the powerful 0–10–0 engine that is regularly engaged in banking duties on the famous incline.

The two "Pacifics," No. 6200, "*The Princess Royal*" and No. 6201, "*Princess Elizabeth,*" are now well settled in their working of "*The Royal Scot*" expresses between Euston and Glasgow and no difficulty has been experienced in keeping time and making the long through working of over 400 miles daily. On a recent run made by No. 6200, "*The Princess Royal,*" on the up "*Royal Scot,*" loaded to 346 tons tare, it was abundantly clear that the schedule allowed a very generous margin, and if desired could be cut considerably. Carlisle was left on time, but so smart was the start and the uphill running that Shap summit was passed fully 4 min. early. Easy running followed, but at Preston the train was 5 min. ahead of time. Signals were on approaching Crewe and a stop was made at Coppenhall Junction. This more than exhausted the time in hand, but on restarting, the schedule was steadily improved upon and Stafford was passed 2 min. early. At Rugby the train was 5 min. before time, and by Bletchley a further 3 min. had been gained. A minute more was saved on the uphill run to Tring and at Watford the train was 10 min. ahead of schedule. By very leisurely running in the last stages, the driver, Earl, of Camden, managed to reduce this by 2 min. and so finally stopped at Euston, 8 min. early.

It would be interesting if the "Pacifics" could be tried on what is probably the hardest locomotive turn on the L.M.S.R. —that of taking the 10.30 a.m. from Euston through to Liverpool and returning the same evening with the up "Flier" leaving Liverpool at 5.25 p.m. and timed to make the run from Crewe to Willesden at an average speed of 64.4 m.p.h. When not divided, the down train loads up to as many as 17 coaches as far as Crewe, 170 min. being allowed for the 158.1 miles, and this would afford the giant "Pacifics" a fitting test of their weight pulling powers, while on the return journey they could display their proclivities for speed.

The "*Royal Scot*" engine and train are back in service again after their extensive tours at home and abroad.



Driver Wm. Gilbertson, who drove "The Royal Scot" during its extensive American tour, receiving a "Summit" fountain pen from Master F. H. Chaffer, while this famous train was on exhibition in Liverpool. Master Chaffer is a keen Hornby Train enthusiast and his extensive miniature railway is remarkable for the realism of its lineside scenery.

New "Moguls" for L.N.E.R.

Orders have been placed for 20 of the standard 2–6–0 "Mogul" mixed-traffic locomotives of the K3 class. Of these, 10 are to be built by Sir W. G. Armstrong Whitworth and Co. Ltd., and 10 by R. Stephenson and Co. Ltd. These engines will be used for both passenger and fast freight services.

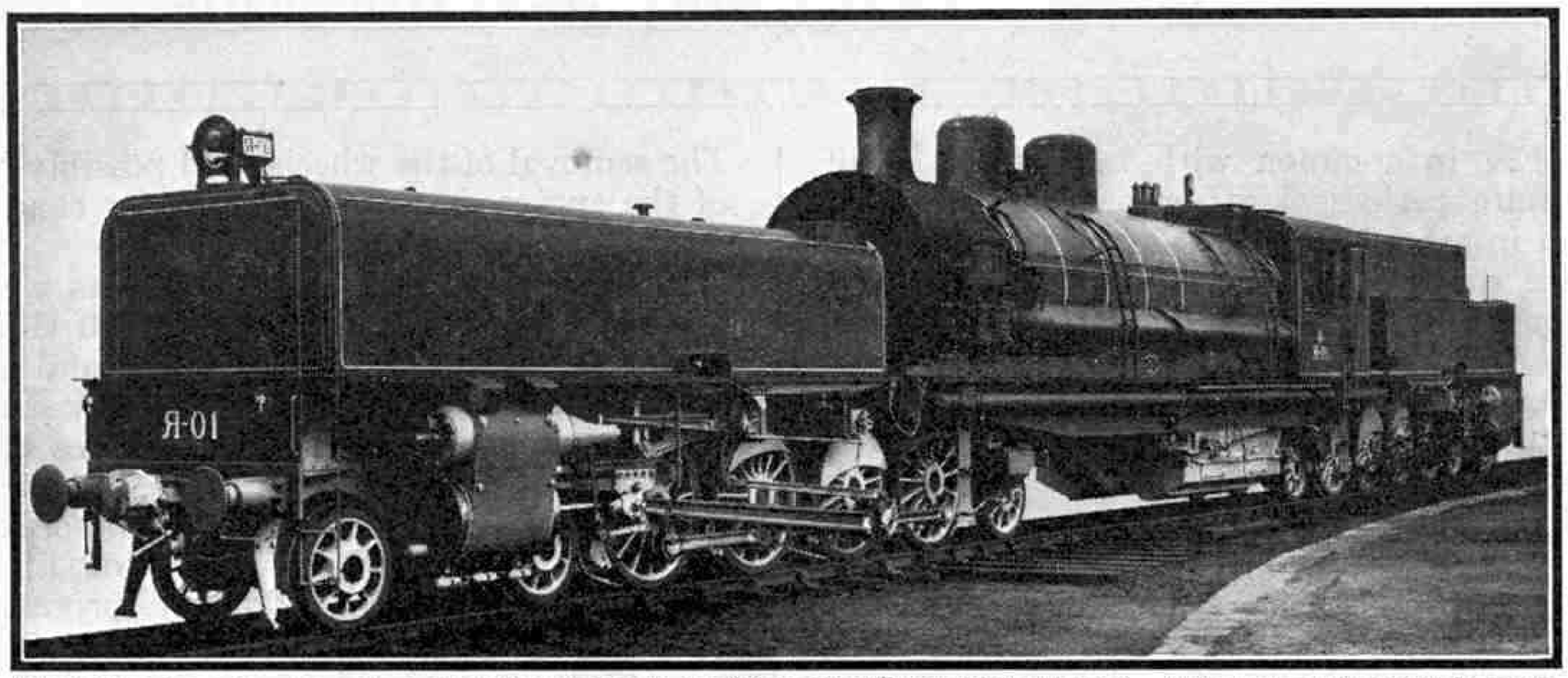
Another interesting piece of rebuilding has just been carried out to the designs of Mr. H. N. Gresley, the Chief Mechanical Engineer, and locomotive No. 732, a 3-cylinder "Atlantic" of the former N.E.R. "Z" class, has been fitted with new cylinders and rotary cam poppet valves and mechanism identical in design and dimensions with those used on the 4–4–0 express engines of the "Shire" and "Hunt" class. These changes have entailed an alteration in the wheel base, and the distance between the centre of the trailing bogie wheel and that of the leading coupled axle has been increased by one foot and is now 8 ft. 5 in. The running board has been raised, and straight outside steam pipes provided from the smokebox to the outside cylinders. As the three new cylinders have each a diameter of 17 in. as compared with $16\frac{1}{2}$ in. formerly, the tractive effort has been increased from 19,320 lb. to 20,446 lb. The rebuilt engine has a smart appearance and will doubtless show improved efficiency in service.

New Coast Line on the "Southern"

The stretch of railway on the "Southern" main line that runs along the coast of Kent between Folkestone and Dover has long been a source of trouble owing to the softness of the chalk cliffs and constant erosion by the sea and weather. From time to time landslides and falls of cliff have caused serious interference with traffic and entailed heavy expense to the company. To avoid these troubles in future, the S.R. propose to construct about four miles of line that will form an alternative to the present route. The new line is planned to leave the present line near Folkestone Junction Station and rejoin it at a point near Shakespeare Cliff, Dover.

The U.S.S.R. "Beyer-Garratt" Locomotive

The remarkably powerful "Beyer-Garratt" locomotive illustrated on this page, and also on page 294, was built by Beyer, Peacock and Co. Ltd., for service on the railways of Russia, which are of 5 ft. gauge. It is 17 ft. 2 in. in height, 10 ft. 6 in. wide and just over 100 ft. long, and has the 4–8–2 : 2–8–4 wheel arrangement. There are four cylinders, each having a diameter of $22\frac{7}{16}$ in. and a piston stroke of 28 in., and the coupled wheels are 4 ft. $11\frac{1}{4}$ in. in diameter. The tractive effort is 72,000 lb.



The 4-8-2 : 2-8-4 "Beyer-Garratt" locomotive now in service on the railways of the U.S.S.R. This remarkable engine is shown undergoing trials in Russia in the illustration on page 294. Photograph by courtesy of Beyer, Peacock & Co. Ltd.

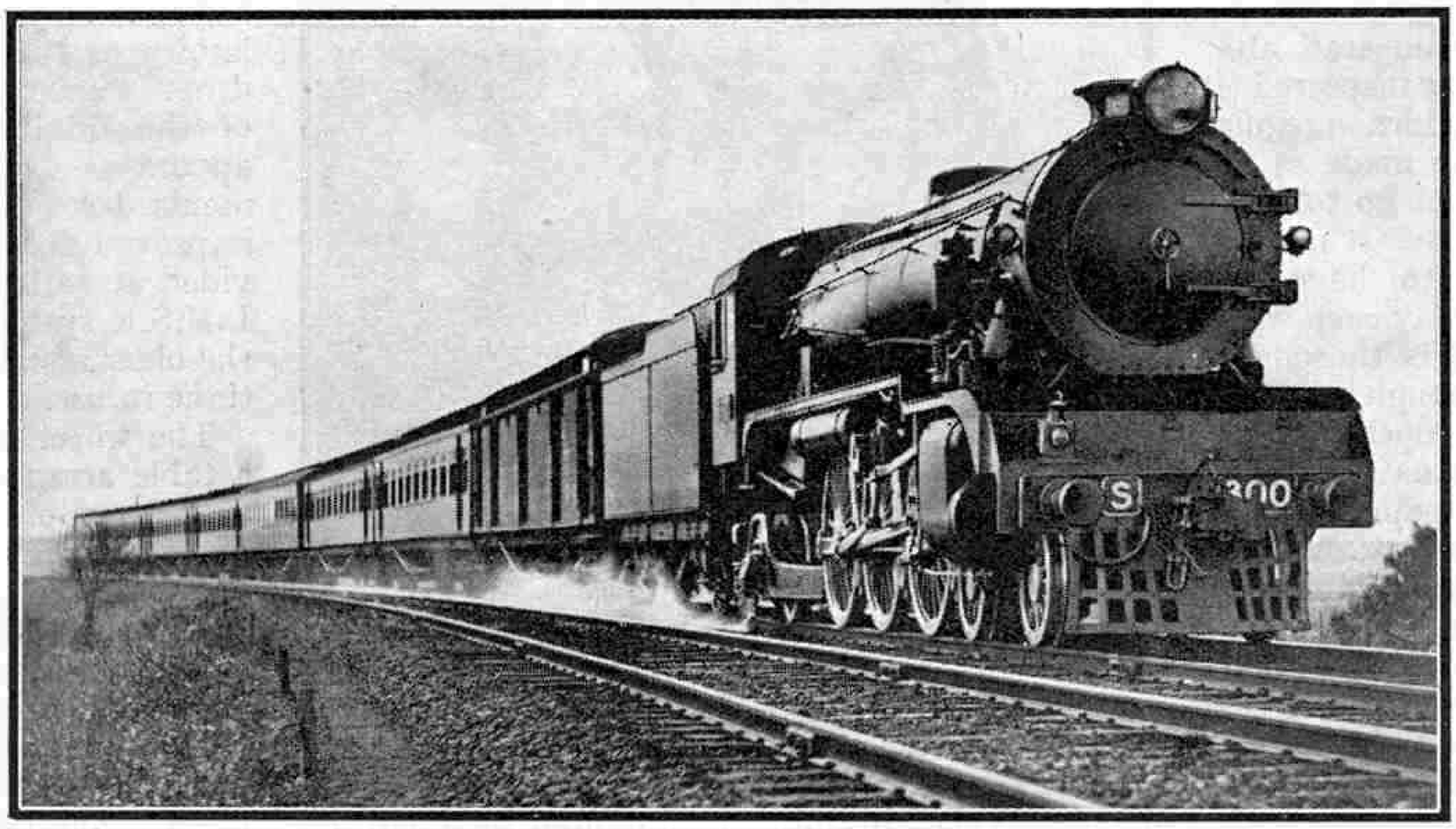
The boiler, with a diameter of 7 ft. 5 in., has a total heating surface of 4,777 sq. ft., and a grate area of 86 sq. ft. The engine is provided with a mechanical stoker and many other aids to efficient and economical operation. It carries 16 tons of coal and 8,130 gallons of water, and weighs more than 200 tons when in full working order.

G.W.R. Locomotive News

The six new small outside-cylinder tank engines the building of which was announced in last month's *"M.M."* have been completed at Swindon and are now in service. The first five of the new engines of the "Castle" class also have been finished and after the usual "breaking in" will be put into express working.

Two further 4–6–0 express locomotives have been condemned. They are No. 2976, "*Winterstoke,*" of the 2-cylinder "Saint" class, and No. 4001, "*Dog Star,*" of the 4-cylinder "Star" class.

The acetylene flame cutting machines that were installed in the works at Swindon some little time ago are proving very effective in operation and are doing much of the work that previously was done more slowly and laboriously by slotting machines. One of the new machines is used for cutting out engine and tender frames from plates or slabs of steel up to $1\frac{1}{4}$ in. in thickness. The plates are placed on the table of the machine and a template having the shape of the frame to be cut is placed above the cutting flame. By means of a magnet fixed above it, the flame is caused to travel round the template until the complete frame has been cut out. The arm from the end of which the flame operates is made to extend or contract on the folding lattice gate principle. Once the machine has been set accurately it works automatically and requires little attention. There are other machines in use that are capable of cutting metal up to 4 in. or 5 in. in thickness. With these also guiding templates are used, and various engine parts are cut out as they are required.



The "Sydney Limited" of the Victorian Government Railways at speed. This train is the fastest in the southern hemisphere, and covers the 293 miles between Melbourne and Albury at an average speed, including six stops, of 49½ m.p.h. The locomotive illustrated is No. 300, the pioneer of the famous "S" three-cylinder "Pacifics" introduced in 1928. Photograph by courtesy of the Victorian Government Railways.

Developments on the Pennsylvania

The Pennsylvania Railroad in the United States, have recently launched a comprehensive electrification programme that is part of the most extensive single programme of railroad improvement undertaken in many years. It involves the extension of electrified services 108 miles southward from Wilmington, Del., to Washington, the electrification of several freight terminals, branches and connecting lines and related improvements. Altogether 646 miles of track will be electrified, and in 1935 electrified through services, both passenger and freight, will be in operation between New York and Washington.

The Last L.M.S.R. "Atlantic"

An event of unusual interest is the withdrawal for scrapping of the L.M.S.R. 4–4–2 express locomotive No. 10316, because this was the last "Atlantic" engine in service on the L.M.S.R. In striking contrast, on the L.N.E.R. many "Atlantics" from the former G.N., G.C., N.E. and N.B. Railways are still at work and some of them are likely to continue so for many years to come.

No. 10316 belonged to the "1400" class of the former Lancashire and Yorkshire Railway, which, because of their tall and handsome proportions and their reputation for speed, were nicknamed "High Flyers." They were designed by Sir John Aspinall and constructed at Horwich Works, and were at the time of their introduction in 1899 among the most powerful express locomotives in Europe. In all 40 of the class were built. These famous engines had very large driving wheels, 7 ft. 3 in. in diameter, and their total weight in working order was 89 tons. For many years they performed excellent work on the expresses between York, Leeds, Manchester and Liverpool, and between Southport and Manchester.

Rebuilding Derbyshire Viaducts

Work has begun in the Derwent Valley between Derby and Ambergate on the reconstruction of three big viaducts that carry over the river the L.M.S.R. main line from London and Derby to Manchester and the North. These are to be rebuilt in order to carry the heaviest types of locomotive. The reconstruction will not be completed until early in 1935, and it involves the use of 1,700 tons of steelwork; the sinking of steel cylinders under air pressure into the river bed, to form supports for the new bridges; the inspection of foundations by a diver to determine effect of scour by the river; and the diversion of certain trains between Derby and Ambergate over alternative routes at weekends, to enable engineering operations to be carried out.

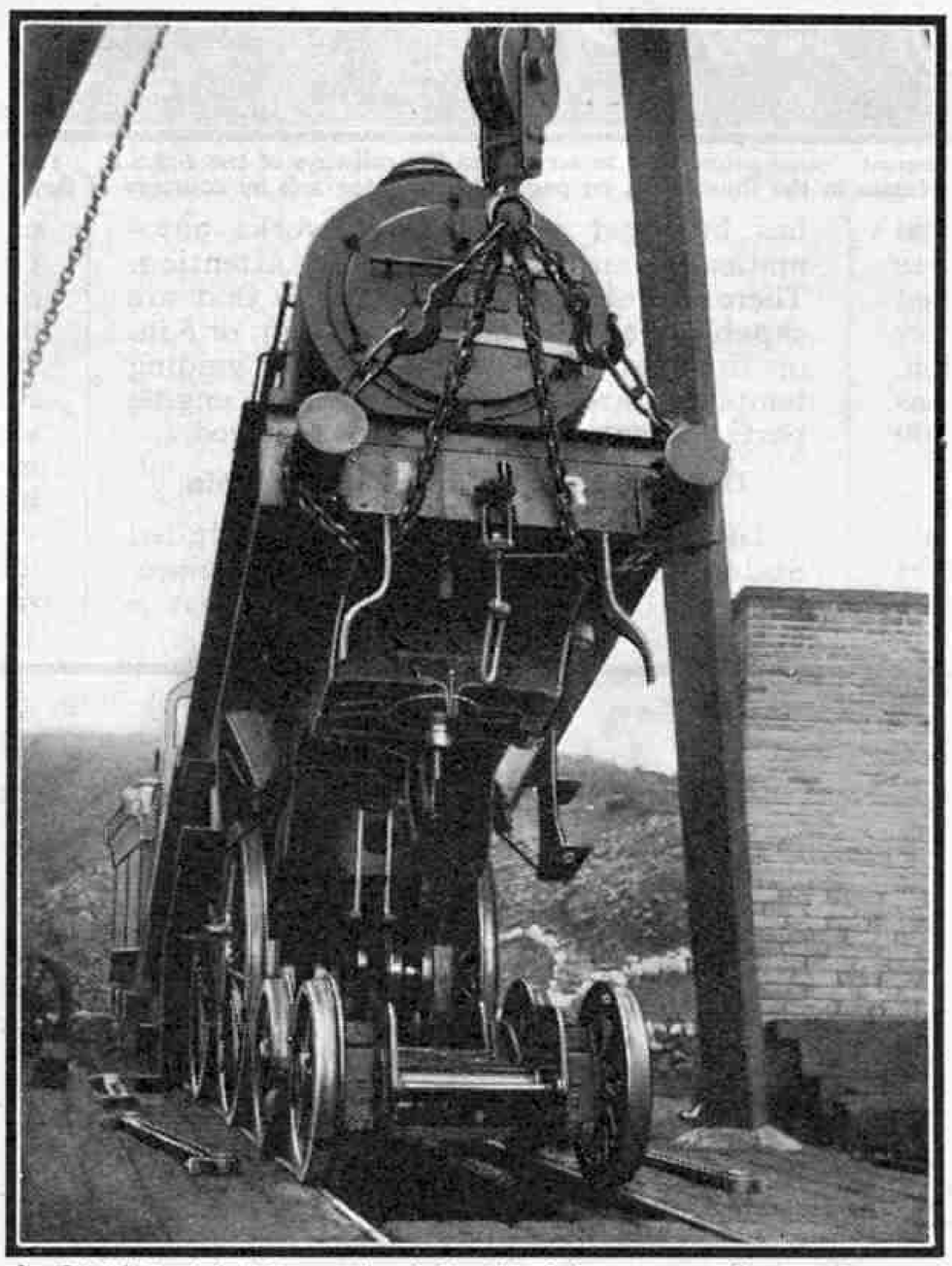
An Aid to Locomotive Maintenance

The Wheel Drop and its Functions

LOCOMOTIVES, in common with machinery of all kinds, require periodical attention and repair to keep them in safe and efficient working condition. How closely the state of engines generally is watched, and how thoroughly the work is done, is reflected by the few engine failures recorded. This is the more remarkable when we remember that such turns as the 400-mile non-stop run of "*The Flying Scotsman*" at 52.4 m.p.h., or the 77-mile sprint of the "*Cheltenham Flyer*" at 71.3 m.p.h., may be included more or less regularly in the duties of particular engines.

Attention on the road is necessarily confined to small adjustments that are carried out by the crew as opportunity occurs. Periodical heavy repairs are effected in the works, and these may include removal of the boiler. The general maintenance of engines is watched by the running shed staff. Any repairs necessary are reported by the driver when he books off duty and leaves his engine to the shed staff after having carefully inspected it for defects. In addition regular examinations are made of the various items that go to make up the locomotive. It is usual for an engine to have one recognised shed day each week, when the boiler is thoroughly washed out, though the frequency of this operation depends upon the nature of the work and the quality of the water. The fire-box, fire-bars and the smoke-box are cleaned weekly, and the trimmings and bearings attended to, in addition to a general "look round." Monthly examinations are made of such fittings as injectors and water gauges, and the water pick-up gear. The safety valves and other parts are examined at the same time. Wheels and tyres are also included in this monthly examination.

An important part of the work undertaken in the running shed is the refitting of the brasses in the axle-boxes which, from various causes as for instance defective lubrication or faulty springs, tend to heat up and cause the white metal linings to run out. This results in the brasses becoming badly scored, so that the re-metalling of them is necessary, while the axle journals have to be redressed. Tyres wear hollow in time, and in the case of driving wheels require attention after a mileage of about 50,000; and flanges wear thin and sharp, so that they are liable to split the points at facing junctions.



An L.M.S.R. 4–4–0 locomotive being lifted by means of sheer-legs and tackle. Photograph by Mr. J. M. Tomlinson, Blackpool.

The removal of the wheels, and possibly the dismantling of the engine, is necessary in order that shop attention may be given to these items.

In former days, when locomotives were generally of light weight, they could be lifted off their wheels when necessary by means of sheer-legs and suitable tackle. This method is still to be seen at many sheds, and is quite satisfactory where only a few engines of moderate size have to be dealt with. With the increasing length and weight of locomotives this method of lifting became a difficult process, and in any case much preliminary work was necessary. The tender had to be uncoupled and drawn back out of the way, and the rear of the engine had to be prevented from moving when the front end was lifted and the bogie detached. An engine dealt with in this manner for attention to the driving axle is shown in the photograph on this page.

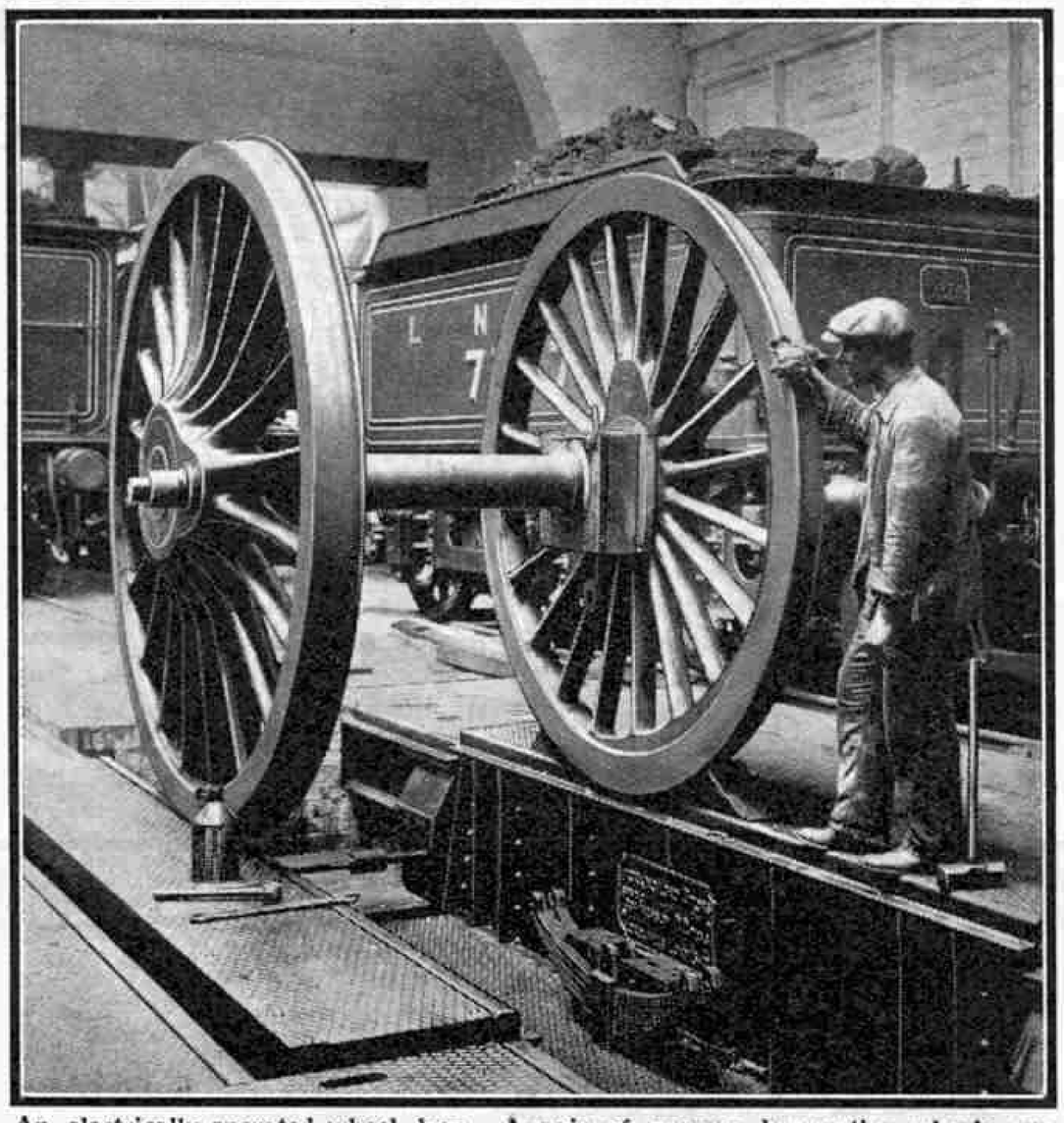
Over 25 years ago the then L.N.W.R. introduced what is known as the hydraulic wheel drop. Since the introduction of the original form of this apparatus various improvements have been made, and improved drops have been provided at various depots on the L.M.S.R. system, while of course the older installations also continue in use.

The wheel drop is, in effect, a table arranged over a pit in the floor of the locomotive depot, of such a length that a pair of driving wheels may be accommodated on it, while the other wheels of the engine are standing on the ordinary rails. At the bottom of the pit there is a hydraulic cylinder and ram, the latter supporting the table, which carries girders of the same depth as the ordinary inspection pit with rails mounted on their top flanges. The engine is made to take up its position with the wheels to be removed resting on the table rails. When such parts as necessary have been disconnected, the wheels, prevented by wedges from moving, are lowered away below the floor.

The gap in the track is made up automatically by side girders, or rails that move into position laterally and so allow the engine to be towed away. These side girders are accommodated under timber housings at the side of the pit, and are connected to the main table by chains. They are also attached by chains to balance weights that ensure their return to the normal position as the wheel table ascends. The wheels can then be

rolled away to be dealt with conveniently. The apparatus is locked by a single lever operating through shafts, rods and cranks the locking bolts on the main table and side girders.

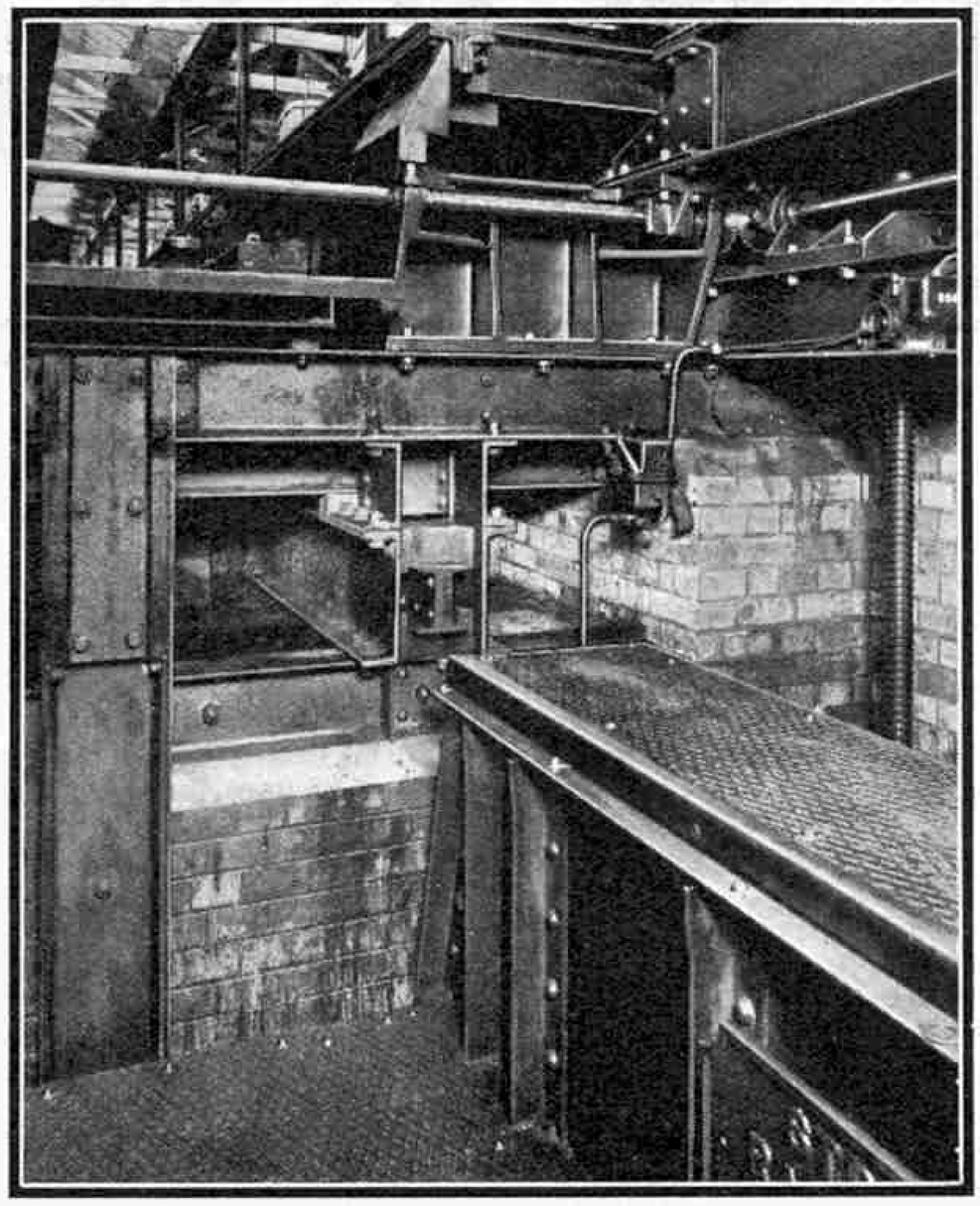
An electrically-driven three-throw ram pump supplies the necessary hydraulic pressure. For lifting the table and wheels alone a pressure of 700 lb. supplied by one ram is sufficient. A pressure of 2,000 lb. is supplied by two rams for compressing the axle-box springs, as is necessary to facilitate the removal of the boxes and their attendant parts. A special combination relief valve eliminates the low-pressure ram when the high pressure ones are in operation, and releases water to the tank when the pressure rises above a predetermined limit. A single lever operates the hydraulic ram by means of a special valve having three positions, "pressure," "exhaust" and "neutral," the last of which enables the platform to be held in any required position.



An electrically-operated wheel drop. A pair of express locomotive wheels are shown on the table, which is raised above rail level. For the photographs on this page we are indebted to the L.N.E.R.

The increasing use of electrical power for general purposes, and especially in workshops, has caused an electrically-operated wheel drop to be introduced, and two of our illustrations show this form in use on the L.N.E.R. The apparatus is manufactured by Ransomes and Rapier Ltd., the late Sir Wilfred Stokes, as managing director of that firm, being responsible for its introduction. The example shown is installed at March, where a large and important locomotive depot with every modern convenience has been fitted up in recent years.

In this form of wheel drop two main girders span the pit provided for the drop. These have rails fitted to them so that in their normal position they preserve the continuity of the main track. When in position the girders are supported on rest bolts which transmit the load directly to the foundations. The main girders are connected by cross girders, and a platform is built in between them of similar depth to the usual repair pits. The cross girders have nuts at each end that engage with vertical screws operated by an electric motor, the drive being transmitted by spur and bevel reduction gear. Thus by operation of the motor the platform is caused to move up or down in the pit as required. One of the vertical screws, of which there are four, is seen in the illustration of the interior of the drop pit.



Raising and lowering of the table are performed by four vertical screws, one of which is shown in this photograph. The traversing of the side girders is effected by means of horizontal screws and bevel gearing.

When the table descends the track is broken, and in order to fill the gap there are two sliding girders situated parallel with and outside the main girders. They too have rails fitted on their top flanges, and are made to slide laterally into the place of the main girders when these descend, so that the main track is again rendered continuous. The sliding girders are traversed by means of horizontal screws driven by spur and bevel gearing from a friction clutch on the shaft that operates the vertical table screws. In the illustration of the interior of the pit one of the horizontal screws and the gearing is easily distinguished.

An engine is run over the drop until the wheels that are to receive attention rest on the table, which is then hoisted an inch or two by the electric motor to the position shown in the upper photograph on this page. This compresses the springs of the axle-boxes and allows the various parts connected with them to be undone. It also relieves the rest bolts, which can be withdrawn to allow the table to descend into the pit after the various rods and motion parts have been disconnected. The degree of dismantling required depends a great deal on the design of the locomotive, and of course the removal of bogie or carrying wheels or even the leading or trailing coupled wheels, involves less work than that of the actual driving wheels.

The side girders are caused to traverse automatically as soon as the main girders or platform have reached a suitable depth, and when they have moved into place they are locked in position so that the engine can be wheeled away. The wheels detached are now returned to the surface again, and are taken away to receive the necessary treatment. Special limit switches prevent the overrunning of the various motions, and ensure the easy operation of the apparatus. The wheel drop has proved extremely successful, and for certain repairs has reduced the time taken from days to hours.

Railway Travel in Russia

Notes on a Recent Journey to Moscow

By a Correspondent

THE prospect of a trip to Moscow gave one a thrill of excitement. Russia, though comparatively near, has never attracted many visitors, and since the Revolution they have not been encouraged until the last few months. What would be the conditions of travel? One had read of the big schemes of railway development, including the building of large numbers of new locomotives, many of them huge ones of the 2–6–2 type, and some even larger. On the other hand, there were reports of the almost complete breakdown of the railways; of interminable delays due to broken rails and other causes; and of the difficulty of finding accommodation on the trains, so that a wait of some days might be necessary. What would the carriages be like in such a democratic country? Would there be any sleeping cars, and if so, would sleep be possible?

We travelled via Berlin and Warsaw. When we passed through the barbed wire entanglements that divide Russia from Poland the contrast was at once noticeable. Smartness of dress and uniform, cleanliness of premises, and orderliness in general gave place to an absence of these conditions. Shabby clothes, soiled tablecloths, and many similar things, spoke of slackness and neglect. Some of the new buildings on the Russian side, however, were of quite smart appearance.

Our luggage was examined by a woman Customs officer in uniform, who registered our cameras on our passports, and gave us a warrant for the amount of money we were taking into the country. We were then permitted to move about the station and inspect the premises and the train. Photography was forbidden, however, and all the time we were closely watched by the many soldiers on duty there. At the refreshment room we had our first glass of "chai," or Russian tea, without either milk or lemon; it was quite palatable, and of a flavour not to be had in England.

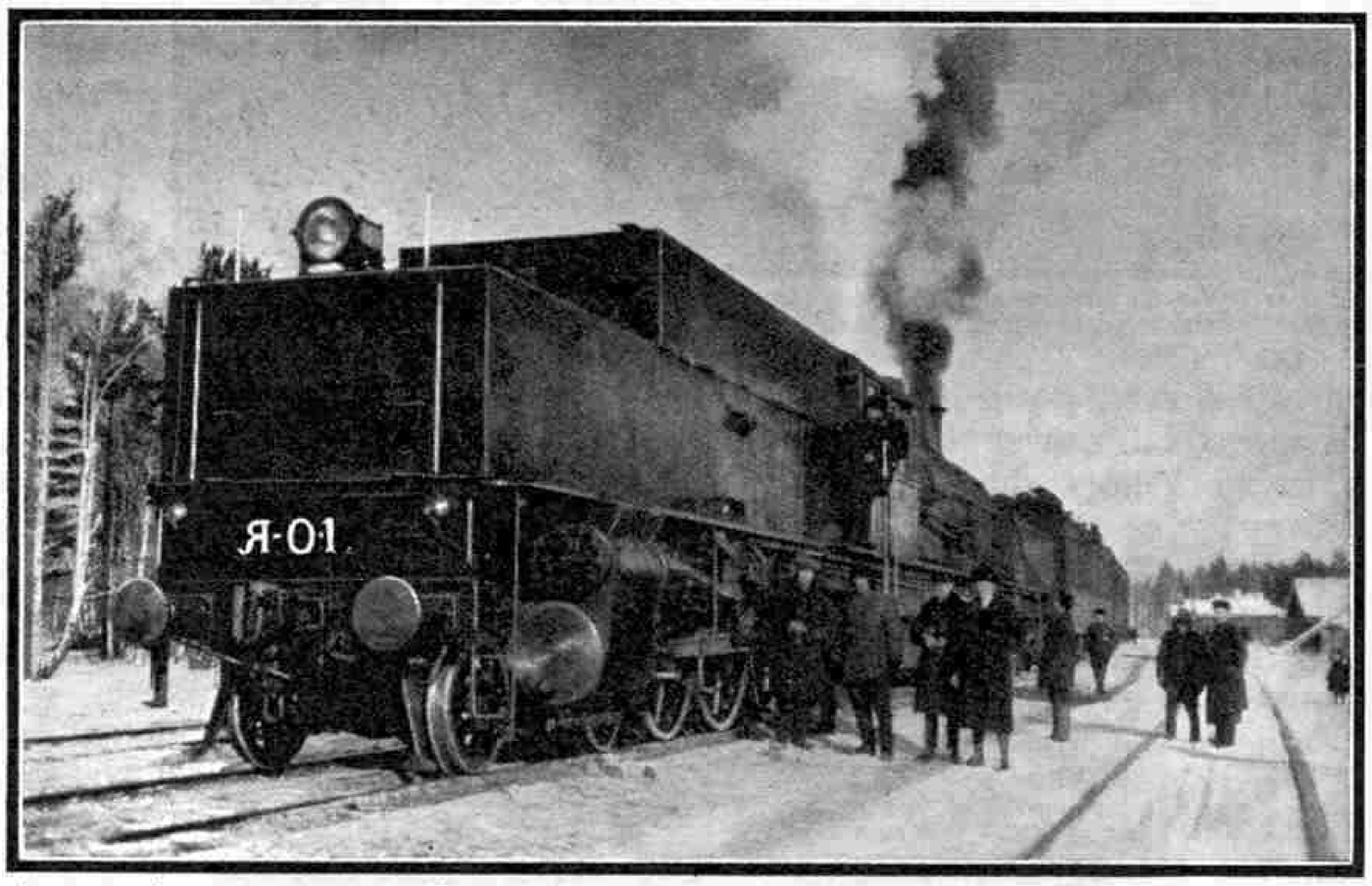
We had grown accustomed to the size of Continental trains, which are larger than English trains; but even compared with Continental stock generally the Russian coaches looked huge. The difference is explained by the gauge of 5 ft. that prevails in Russia, as compared with the normal gauge of 4 ft. 8½ in. elsewhere. The loading gauge, too, is exceptionally generous, and permits a height of 17 ft. 2 in.

The engine, to our eyes, looked rather strange and spidery with its boiler mounted high above the motion, and with an air-brake cylinder placed athwart the frames under the boiler. Most of the engines have a footwalk all round the boiler, with a guard rail outside.

The classes of carriage are "Hard," "Soft," that is cushioned, and "Sleeper." The sleeping cars, which were pre-war Wagon-Lits, we found to be reasonably comfortable. Each compartment contained two berths, an upper and a lower, the lower berth lying across the carriage, and the upper one along the side of it. Between each two sleeping compartments there was a cubicle containing a wash basin, but no towels were provided. A door from each of the two compartments opened into this cubicle, and by an ingenious arrangement of levers the locking of one door also locked the other, and vice versa—a very necessary provision to ensure that the occupants of one compartment had not a monopoly. Our chief discomfort was lack of air. The compartments were lofty, but the windows were kept strictly closed, except at stations, on account of the sandy nature of the ballast, which rose in clouds as the train passed. Still, the berths were clean and roomy, and as the speed of the train was moderate we travelled comfortably and had a good night.

These coaches run between the Polish frontier and Vladivostok. On the return journey we joined a train that had crossed Siberia, and in this the water for washing resembled coffee grounds in appearance and consistency.

Food on the train was somewhat better than we had expected, in view of the reports we had heard of its scarcity. For breakfast we got three eggs each. Dinner consisted of green salad, omelette, veal and fried potatoes, and tinned fruit. It was not appetising, and the condition and dress of our waiter did not add to our enjoyment of the meal. The charges for meals were most astonishingly high, partly owing to the very poor rate of exchange.



An interesting railway scene in Russia showing a giant "Beyer-Garratt" locomotive undergoing trials. See also page 291. Photograph by courtesy of Beyer Peacock & Co. Ltd.

Moscow, the object of our journey, has grown enormously since the Revolution, and is now one of the largest cities in the world. We found the streets thronged with people at all hours, from early morning until late at night. The lack of facilities for travel was very noticeable, and the trams, although giving a good service, were overcrowded to a remarkable degree, passengers hanging on to the steps like bunches of grapes! To remedy this congestion it is proposed to construct a comprehensive system of underground railways on similar lines to the London "Tubes." A few of the suburban railway lines are either already electrified or in course of electrification.

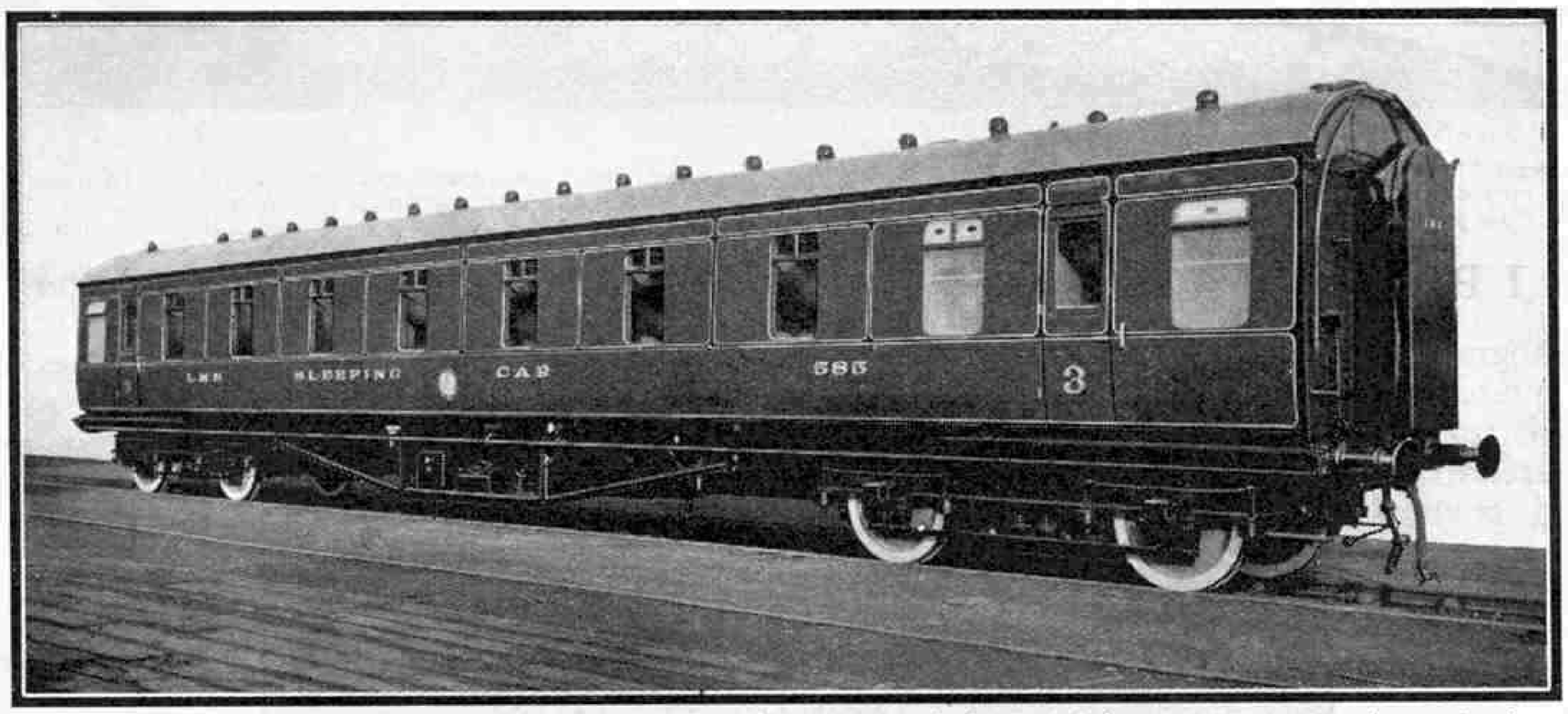
Among the modern buildings of Moscow are some that are really very attractive, notably the new Post Office, the Lenin library, and the Kazan railway station. This last is a handsome building, beautifully appointed inside, and with a waiting room that resembles the Chapter House in a cathedral, and a refreshment hall as ornate as a modern cinema theatre. The Northern station is not modern, but some effort has been made to improve it; beds of flowers, mostly pansies, were laid out in the concourse. We had heard that at some stations creches were provided for children whose parents had to leave them for a period to go into the City or elsewhere. We asked to see the children at this station, and after climbing flights of stairs and going along passages we were taken to a room and shown some 30 children, poorly dressed but clean and tidy, in the care of a kind-looking woman in a white overall. They were sitting at tables waiting for lentil or some such soup that was being ladled out for them. From the reports, one becomes suspicious that places are specially prepared for inspection by visitors, but we felt satisfied the group of children we saw were not assembled for propaganda.

A big effort is being made to improve the streets, but many of them are in a bad condition and must be in a deplorable state in winter, especially when there are heavy falls of snow. It is reported on occasions, that snow as much as three feet deep may fall in a night. Many of the streets and principal squares are floodlit from lamps placed on the roofs of surrounding buildings, and the effect is very fine.

L.M.S.R. Third-Class Sleeping Cars

Luxury Travel On West Coast Route

IN 1928 the L.M.S.R., L.N.E.R. and G.W.R. made the important introduction of vehicles with sleeping accommodation for third-class passengers. The advent of these coaches was a great benefit to the travelling public, for previously sleeping cars were available for first-class passengers only, and third-class passengers were obliged to rest as well as they could on the ordinary seats. With more than two people travelling in a compartment this became awkward if not impossible.



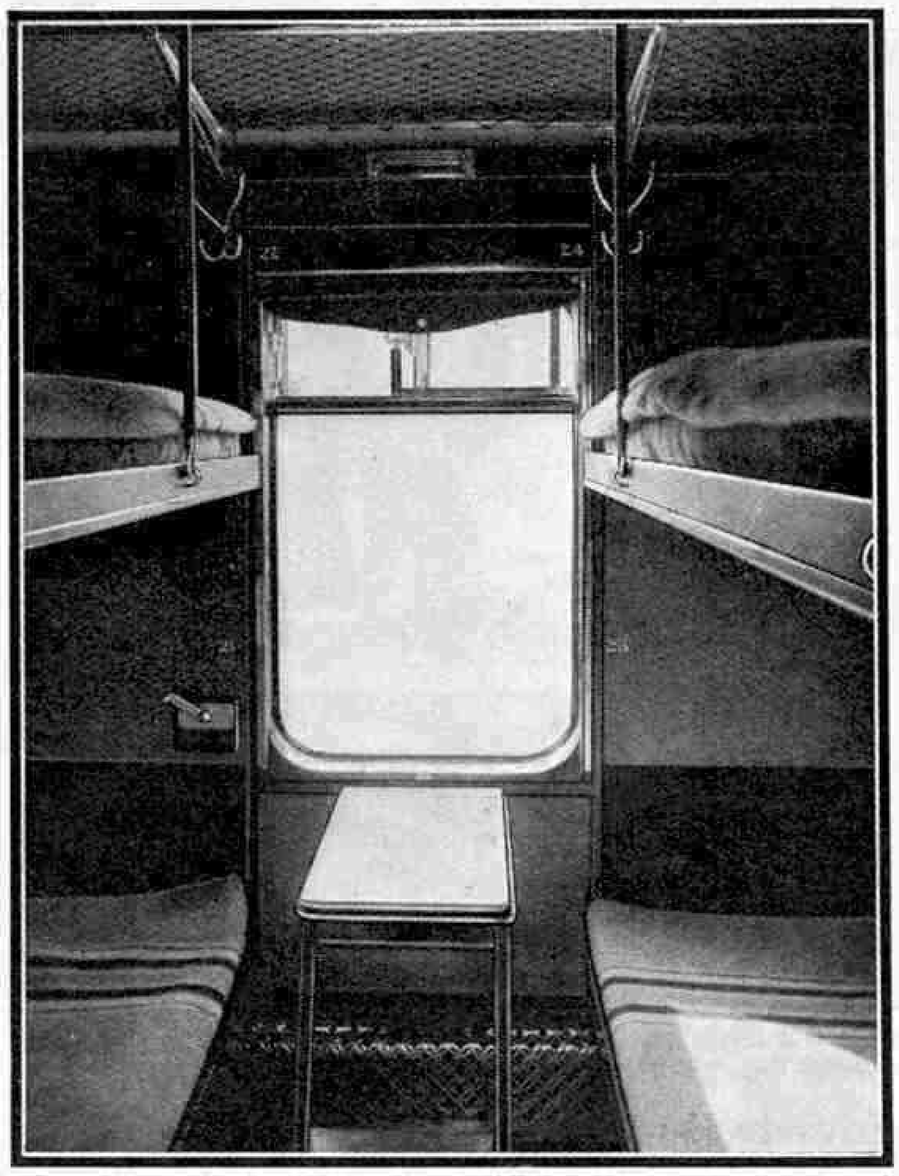
One of the L.M.S.R. third-class sleeping cars. These are luxuriously fitted up inside, and their external appearance is very pleasing. The photographs on this page are reproduced by courtesy of the L.M.S.R.

A notable advance was made last year by the L.M.S.R. in putting into service a number of third-class vehicles that are essentially sleeping cars; that is, they are solely for night use, and are not convertible for day travel as is the case with the earlier third-class sleeping coaches. The first of these to be built was included in the L.M.S.R. train that went across to America, and others are running chiefly on the Anglo-Scottish night services. It is interesting to note that it is just over 60 years since the first sleeping car was introduced on the West Coast Route. The first cars carried out an experimental thrice-weekly service between Euston and Glasgow, and from this small beginning there has grown up a regular night service on all the principal routes on the system, necessitating over 220 sleeping cars.

The new cars have been designed by Mr. W. A. Stanier, Chief Mechanical Engineer of the L.M.S.R., and have been constructed at Derby. Each car is of the corridor type with an entrance vestibule at each end, and in addition an attendant's compartment is provided. There are seven sleeping compartments, giving accommodation for 28 passengers. The body, which is 65 ft. 1 in. long, has framing of teak, finished on the outside with steel panels, the exterior being designed to give a flush finish and balanced elevation. The cars are finished in the standard rich Midland red shade, with the usual panelling and lining. The company's crest adorns the centre of the lower panels on each side.

To eliminate track and running noises the floor is made up of cork laid on dove-tailed steel sheeting, and a blanket of insulating material is fitted to the whole of the underside of the body floor. The underframe, 65 ft. long, is of L.M.S.R. standard construction, incorporating rolled steel sections. The bogies are of the four-wheeled type of standard design, having helical concentric bolster springs and laminated side bearing springs. Rubber auxiliary springs are provided, and the vehicles run on steel disc wheels.

Each compartment contains four berths, and the arrangement of these may be gathered from the interior illustration on this page. The walls are finished in stippled brown Rexine, and the mouldings and berth frames with Rexine of a shade to match. The ceiling is of three-ply wood covered with Rexine of a pale cream shade. The metallic fittings are chromium plated. The berth mattresses are of two types, half the car being equipped with "Vi-Spring" and the remainder with "Latex" rubber mattresses. With the addition of a rug and pillow very comfortable sleeping accommodation is provided. The fittings comprise a mirror on the sliding door of the compartment, a rack for light articles, and coat and hat hooks. A combined ascending ladder with table top is provided for the use of occupants of the upper berths, and a recess for attaché cases and other articles extends over the corridor ceiling. The floor is covered with a rubber mat of special design, and the window blinds are fitted with "Zip" Flexide fasteners.

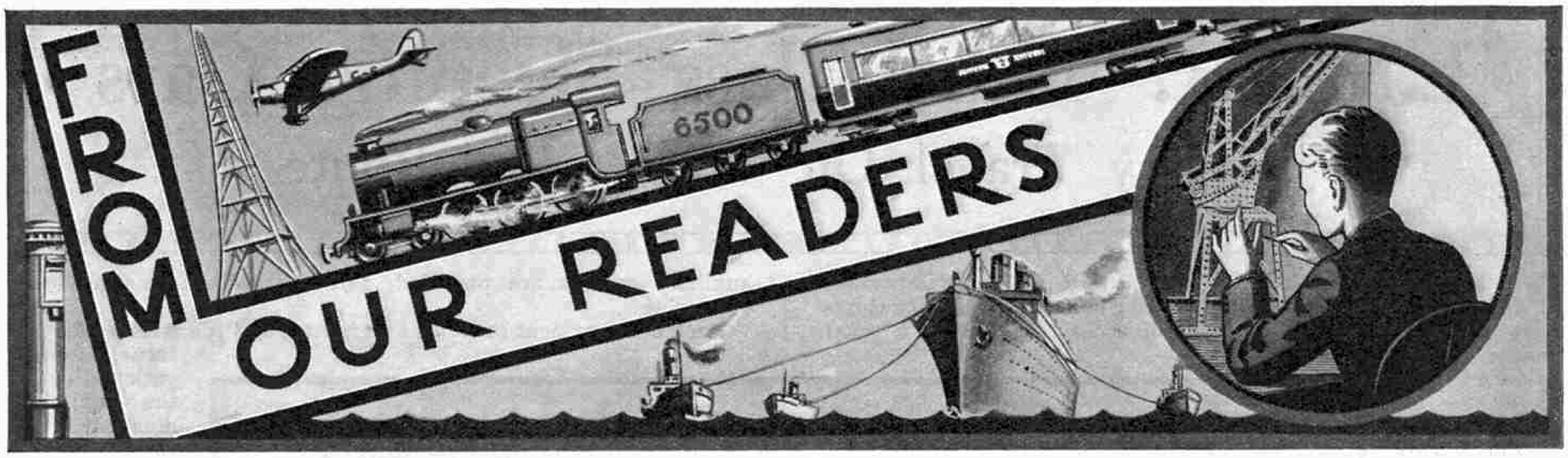


An interior view of one of the compartments, showing the upper and lower berths.

The corridor walls above the waist are finished in stippled brown Rexine, and below with mahogany framing and panelling. The sliding doors leading to each compartment are finished on either side to match the decorative schemes in the compartments and in the corridor respectively.

Each compartment has a 60-watt lamp with an orange "Nacrolaque" shade and a blue night light is situated over the sliding door. Either one or the other of these lights is always illuminated, so that the compartment is never in complete darkness. At the head of each berth a combined bell push and reading lamp is fitted. The light from the latter reflects only into its own berth, and thus does not interfere with the other occupants of the compartment. The corridor lights can be dimmed by the attendants.

The compartments are heated by Westinghouse steam heaters controlled by Bowden wires, and are arranged along the body side, passing under the feet of the lower berths. The exposed portion is covered by a grill. Three concealed heaters are fitted in the corridor. The "scoop" method of ventilation, as described recently in the "*M.M.*," is incorporated, the scoops being arranged along the corridor body side in series to suit the direction of travel of the car.



These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

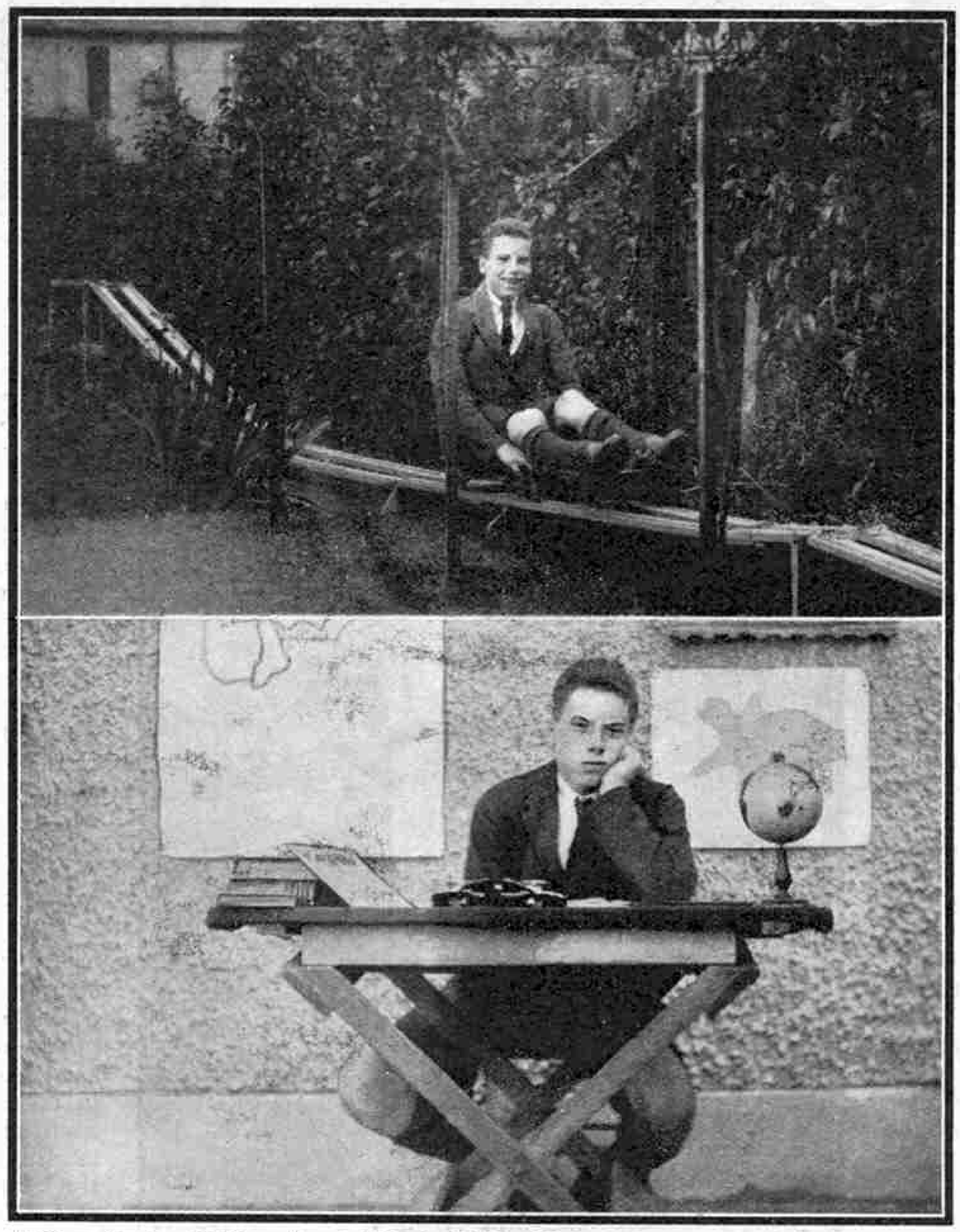
How I Photographed Myself

The two photographs reproduced on this page were taken on one plate with a half-plate stand camera. After setting this up and focussing, I repaired to the dark room and covered one half of a plate in the dark slide with a piece of black paper. I then exposed the remaining half for the upper picture, "*Home for the Holidays*," and again entered the dark room, where I moved the piece of black paper from the portion of the plate that it had protected to the other half. I then replaced the slide in the camera and took the lower picture "*Back at School*."

Although I am the subject of the two photographs I exposed the plates myself. "*Home for the Holidays*" is a joyful scene on a miniature switchback and was photographed with the aid of a railway signal constructed of Meccano parts. At the bottom of this signal I fitted a Meccano rod to turn on a swivel. One end of the rod stretched across the track of the switchback and to the other end was fastened a fine piece of string, which trailed along the left hand side of the track and was attached to a contrivance supporting a heavy weight that was suspended over the rubber ball of the pneumatic shutter of the camera. This ball rested on a table by the side of the camera, and in order to take the photograph I sat on the car of the switchback, which was then allowed to run down the track. As it did so, it turned the rod, and this had the effect of tightening the string and releasing the weight, which fell upon the ball of the shutter, thus exposing the plate.

The lower photograph, which shows me in a more doleful mood, was taken in a similar manner, but this time the weight was released by simply pulling the string.

V. KNILL (Thorpe Bay).



"Home for the Holidays" and "Back at School," two photographs taken on one plate by V. Knill, Thorpe Bay, who made the exposures himself by the ingenious means explained in the accompanying article.

The Sargasso Sea

Recently I travelled from Vancouver to London. The journey began with a motor run of 900 miles to San Francisco, where I went aboard the vessel in which I was to cross the seas. After calling at Los Angeles, we passed along the coast of Guatemala, where we encountered a bad storm in which I became seasick for the first time in my life. I hope sincerely that it also will be the last time!

On arriving at Panama, we anchored outside Balbo for the night and started to go through the Miraflores Locks early the next morning. The Captain told me that a boa constrictor dropped on deck during one of his passages through the locks, but I did not experience anything so startling.

Our course across the Atlantic Ocean took us through the Sargasso Sea, and I determined to catch some of the famous seaweed there. I threw overboard the end of a strong line weighted with nuts and provided with bent nails in the hope that a bunch of seaweed would become attached to them. The task of hooking the seaweed and getting it safely aboard proved more difficult than it looked, however, and I only obtained four pieces after fishing for three days!

J. F. ASSER (Littlehampton).

Bird Nesting with a Camera

Taking photographs of birds' nests is a much more satisfactory hobby than collecting eggs, for the eggs are undisturbed and there is no cruelty or risk of hastening the disappearance of rare species. A further advantage of photography is that the camera gives permanent records of the nests as well as the eggs, and fascinating pictures showing the birds themselves at home also can be obtained. The hobby calls for the exercise of skill and patience, for the birds must not be alarmed if success is to be attained; but the resulting pictures amply repay the time and efforts spent in securing them.

A nest of the red grouse with four of the bird's eggs in it. The eggs are creamy in tint, and have deep reddish-brown markings. Photograph by H. McMaster, Glasgow.

My own plan in pursuing this hobby is to set up the camera and focus it sharply on the nest in order to find the distance at which it must be concealed. The lighting at various times of the day, and the position of the bird when she is sitting, also have to be considered when deciding the exact position in which this is to be placed. When these points have been settled a natural-looking structure must be built up in order to prevent the bird from seeing the camera. This structure is usually called a "hide," and it must match its immediate surroundings. It must not be constructed rapidly, for its sudden appearance would create alarm. For this reason I take great care to allow the bird to see it growing branch by branch, and twig by twig, until it is about four ft. long and three ft. high, and I usually spend at least a week on these preparations.

When the hide has been completed to the mutual satisfaction of myself and the sitting bird, I seize a suitable opportunity of placing the camera in it with the lens pointing through a small hole near its centre. I then focus sharply on the nest, insert a plate, withdraw the dark slide, and retire after setting the shutter at the right speed.

An hour later I return to the hide with a friend and after completing preparations for a long wait my accomplice goes away. This trick deceives most birds into the belief that they may return to their nests without fear. Ravens and crows are exceptions, however, for they seem to be able to count and find it suspicious that only one of the two intruders retires. Then I wait in patience until the bird settles down on the nest in the most favourable position, and make the exposure.

It is much easier to obtain photographs of the eggs, and the accompanying illustration shows a nest of a red grouse with four eggs in it. This bird can be found on our moors at heights above 1,000 ft. It begins nesting towards the end of April or early in May, and as the photograph shows, it builds a crude structure of sprigs of heather and coarse grass in a hole in the ground. Early in May from 8 to 11 creamy coloured eggs, heavily marked with deep reddish-brown blotches, make their appearance and sitting commences. The bird sits very tightly, particularly a day or two before hatching, and I had to lift the bird off the nest of eggs illustrated in order to obtain the photograph. She did not fly away, but strutted round with the tips of her wings trailing on the ground, making an angry clucking noise. H. McMaster (Glasgow).

Scenes in Venice

"Queen of the Adriatic" is the very appropriate title given to Venice, the buildings of which have a wonderfully stately and attractive appearance that is in striking contrast to that of the colder, harder structures of Milan and Rome. As one stands in the Piazzeta, or St. Mark's Square, one is first attracted by the wonderful facade of St. Mark's Cathedral. Then the Campanile, towering up into the dark blue sky, catches the eye; from the belfry of this tower a wonderful view of Venice is obtained.

A fruit-laden gondola on the Grand Canal, Venice. Photograph by J. Matthews, St. Ives.

In the Piazza, a smaller square entered from the Piazzeta, stands the Doge's Palace. This building, which was the palace of the Dukes of Venice until 1789, when Lodovico Nanin, the last Doge, died, is constructed of pink marble, the colour of which presents a wonderful contrast to the blue of the sky and of the waters of the lagoon facing it.

The streets of Venice are canals on which travel gondolas, long wooden boats capable of holding five people. The gondolier propels and steers his craft with a long oar that he pushes through the water. The Grand Canal is the main "street" of Venice. On it there are steam-boats and motor-boats as well as gondolas, and into it run hundreds of tiny side canals, called rios, that are just wide enough to allow two gondolas to pass. J. Matthews (St. Ives).

The Story of Artificial Silk

III.—From Pulp to Finished Thread

By W. F. Harrison

IN the two previous articles in this series I described the various processes evolved during the last century in the making of the imitation silk filament now known as rayon.

The four leading methods by which success has been achieved in this direction have had for their basis Nature's most prolific substance, cellulose, a fibrous mass of plant cells contained in cotton, flax, hemp and straw, and in the wood of the tree itself. Of all the forms in which cellulose is to be found, cotton and spruce wood have proved themselves to be best adapted for conversion into rayon filaments.

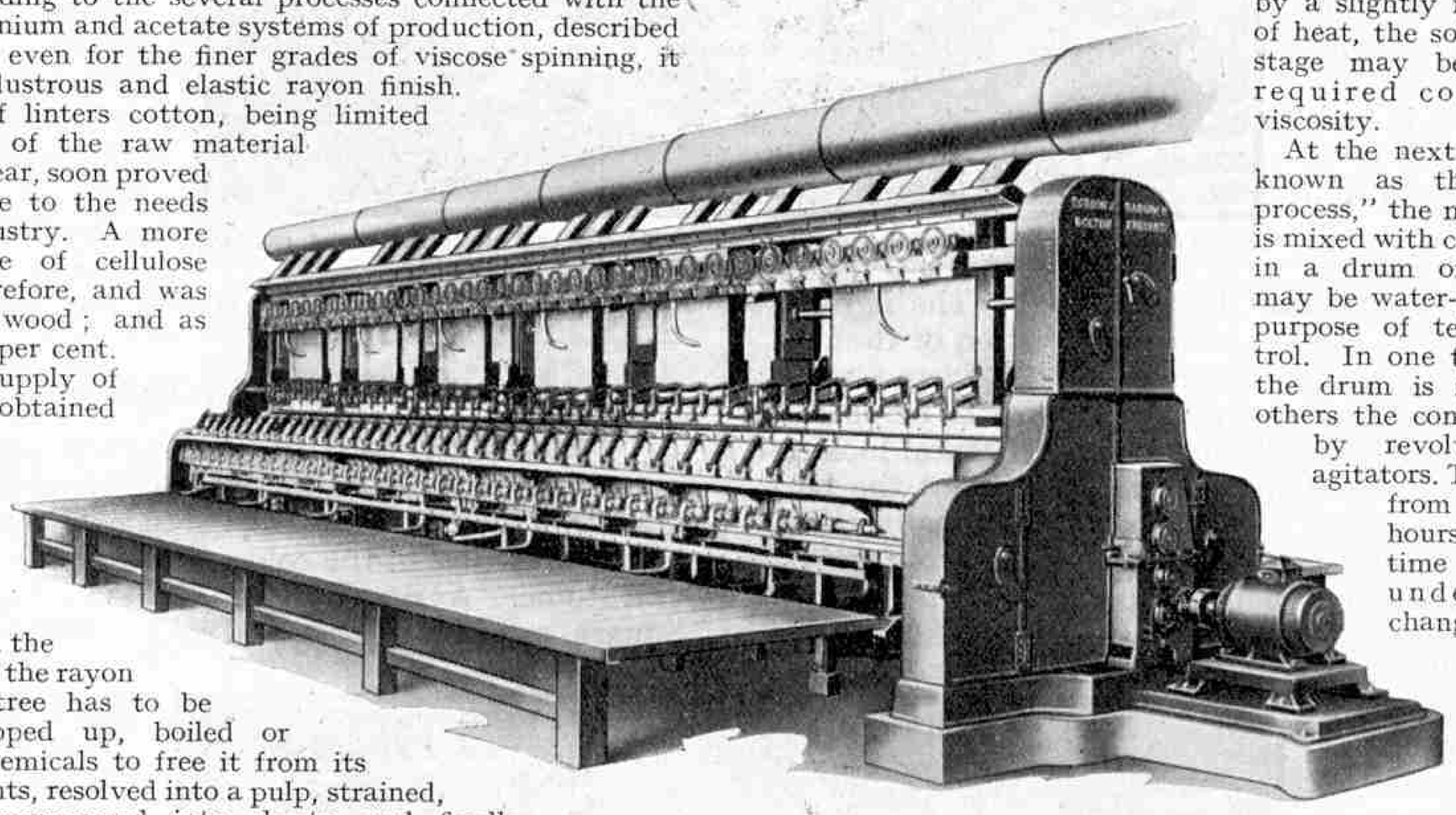
Cotton in its cheapest form, that of linters, or the short and immature hairs separated from the fibres intended for spinning purposes, is 90 per cent. cellulose. When this cotton is treated chemically according to the several processes connected with the nitro, cuprammonium and acetate systems of production, described last month, and even for the finer grades of viscose spinning, it gives a strong, lustrous and elastic rayon finish.

The supply of linters cotton, being limited by the amount of the raw material processed each year, soon proved to be inadequate to the needs of the new industry. A more abundant source of cellulose was sought, therefore, and was found in spruce wood; and as a result over 85 per cent. of the world's supply of rayon is now obtained from this timber by the last-named process. I have already described how, in order to yield up its cellulose in the state required by the rayon producers, the tree has to be sawn and chopped up, boiled or digested with chemicals to free it from its woody constituents, resolved into a pulp, strained, bleached, and compressed into sheets, and finally baled for shipment. I now propose to follow the course of this bale of bleached sulphite wood cellulose through all its stages until it emerges as a thread, and is reeled into hanks for dyeing in all its lustre as a filament that only the expert can distinguish from the queen of all fibres, natural silk itself.

The contrast between the modes of treatment undergone by cotton and artificial silk will be most apparent when the progress of a bale of cotton from the "bale-breaker" to the "gassing frame" is considered side by side with the manufacture of rayon. In the case of cotton the results are attained entirely by mechanical means. The fibres are loosened by spiked rollers, cleaned by beaters, carded by fine wires, and parallelised and spun by the action of roller and spindle; all by actions patent to the observer. On the other hand, the changes wrought on the block of wood pulp are in the main of a chemical nature. At an early stage it has to be compressed and shredded, but it is only the final or spinning process that bears any resemblance to any associated with cotton.

In the production of rayon it was the practice formerly to commence operations by breaking up by hand the sheets of wood pulp, and feeding the pieces into a kneading machine or disintegrator. In this machine the cellulose material was ground, steeped in a solution of sodium hydroxide, and converted into a thick paste. The excess of solution was then forced out, and the remaining alkali cellulose was pressed by hydraulic means into the form of a cake or cheese. In more modern practice the sheets of sulphite wood cellulose are cut to smaller sizes in order to fit into wire baskets or perforated metal boxes which, when packed, are lowered into a vat containing a strong solution of caustic soda. When the sheets are thoroughly saturated the excess liquor is squeezed out by powerful rams, and the sodium cellulose compressed. Here the absorbent qualities of the cellulose material are revealed, as bulk for bulk its weight is three times as great as before.

The resulting blocks of cellulose are then shredded or reduced to crumbs in a closed grinding machine where the lumps come into contact with spiral knives that reduce them to crumbs. The particles are placed in containers, which are then sealed up and the contents allowed to mature or ripen for a certain period and at a given temperature. The ripening process is of the highest importance, and its duration is influenced largely by the temperature, one or two degrees being equivalent to a difference of several hours. From this it will be apparent that control of this factor is a vital matter, for it may be understood that if the ripening is hastened by a slightly increased degree of heat, the solution at a later stage may be short of the required consistency, or viscosity.



A modern rayon spinning machine. Photograph by courtesy of Dobson and Barlow Ltd., Bolton.

At the next stage, which is known as the "zanthating process," the matured cellulose is mixed with carbon disulphide in a drum or churn, which may be water-jacketed for the purpose of temperature control. In one type of machine the drum is rotated, and in others the contents are mixed by revolving arms or agitators. The process takes from three to four hours, during which time the contents undergo certain changes of colour, first from white to yellow, and afterwards to an orange red. Samples are withdrawn from time to time and tested, and when the cellulose zanthate is deemed satisfactory the machine is stopped and the excess of carbon disulphide drawn off.

The cellulose zanthate, now highly inflammable, is transferred to a closed mixer or container, in build not unlike a vertical boiler, water-jacketed, and provided with gauges to register temperature, pressure and vacuum. Here it is converted into viscose by the addition of caustic soda diluted in water, the solvent being introduced slowly at first and afterwards added with increased rapidity. The mixing is effected by blades or propellers as in certain types of the machine previously described.

The next processes are concerned with the filtering and ripening of the viscose. The filters are graded, and range from those made of wire gauze, or presses consisting of cotton wool held in gauze bags, to those filled with woven material such as the finest cambric. In a closed container the solution undergoes a final period of ripening. The last operation previous to spinning is to clear the viscose of air bubbles, a function of the highest importance, for if these were allowed to go forward the result would be so many broken filaments. The liquid is therefore subjected to a vacuum for at least 24 hours.

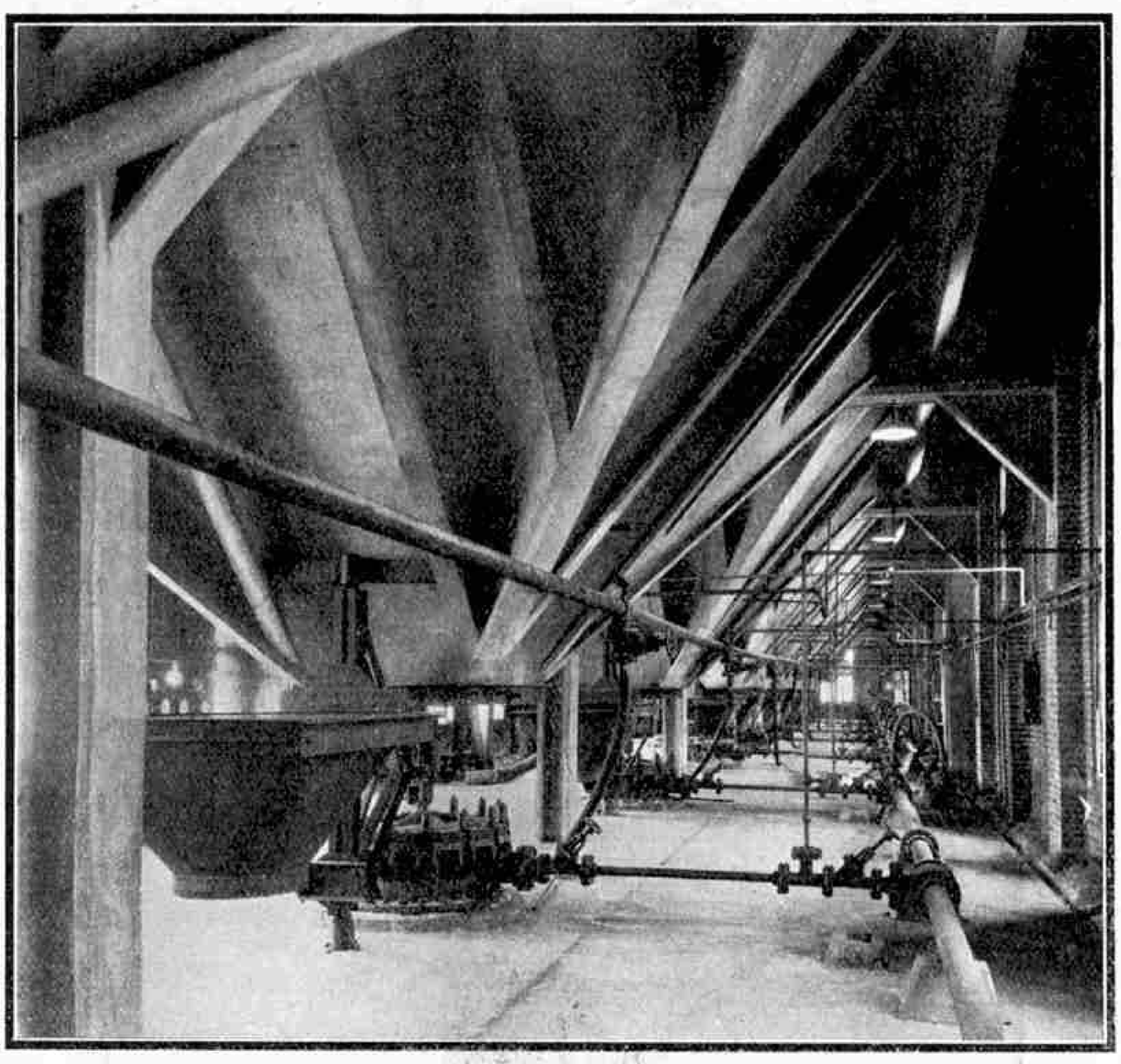
When thoroughly filtered and de-aerated, and of the correct viscosity, the solution is forced into the main pipe leading to the spinning department, and by branches is led to each machine and ultimately to each individual pipe connected with a spinning set.

It has already been pointed out that there are, broadly speaking, two methods of spinning rayon, the one dry, as exemplified in the Chardonnet and acetate processes, and the other wet, instanced mainly by the cuprammonium and viscose systems. There are also two types of spinning machine in use, namely, bobbin spinning and centrifugal spinning. In the former the filaments are produced

in exactly the same manner as in the latter except that, instead of being spun, they are wound like a tape warp or a narrow ribbon round a bobbin of wood or glass, and taken away to be spun on separate machines by methods similar to those adopted for real silk. In centrifugal spinning the two operations are consecutive and are carried out by what may be described as the same spinning set. This is the method to be described, as it comprises all the functions of the bobbin machine as well as its own special features.

Modern spinning machines generally contain 72 spindles, 36 on each side, and these in turn may be sub-divided into sections of six each containing six spindles. Each spindle may be regarded as a self-contained spinning set, which means that it has its separate pump, candle filter, glass goose-neck, spinneret, godet or glass roller, glass guide funnel and centrifugal spinning box.

The viscose is fed to each spinneret by a pump that forces it through a filter and onward by way of the goose-neck to the spinneret, and thence through fine orifices into its surrounding bath. This bath neutralises the alkali solvent and fixes the cellulose into semi-solid filaments that are drawn together upward and led round the glass godet or roller so that they may drop vertically down through the glass guide funnel into the centrifugal spinning box, where they form into a cake or cheese.



The charging floor of the Digesting House, showing the bins from which the wood chips conveyed from above are fed into huge boilers on the floor below. The illustrations on this page are reproduced by courtesy of Riordon Sales Corporation Ltd., Montreal.

The pump that feeds the viscose is one of the most interesting and vital parts of the mechanism. The evenness of the filament discharged from the spinneret depends on a regular and unvarying feed from the pump, and the pump therefore must deliver an exact quantity at a constant rate while the machine is in motion. To this end three separate types of pump have been evolved, the hydraulic, the wheel and the piston. The first has been discarded. In the gear wheel pumps, which are arranged in line, one in front of each spinneret, the solution is fed through geared wheels working in a recessed plate, the viscose passing between the wheel teeth. This may be regarded as the simplest form of feed, but one apt to vary, in spite of the accuracy of the wheel cutting.

The piston pump, first patented by Stearn and afterwards developed by Clayton, is considered the best for the purpose. Each separate pump is driven from a main shaft by gearing, rotation being given to a light central spindle fixed in the pump by a toothed wheel mounted at its end. To the same spindle are fixed a series of cams that operate the plungers. It has been maintained that three plungers could be relied upon to feed the viscose within five per cent. of variation, but this could be diminished by increasing the number of plungers.

When the viscose leaves the pump it enters the candle filter, which is made of acid-resisting ebonite or hard rubber, and it is forced through packing of down or of fine woven textile material into the glass tube or goose-neck and thence into the nozzle or spinneret.

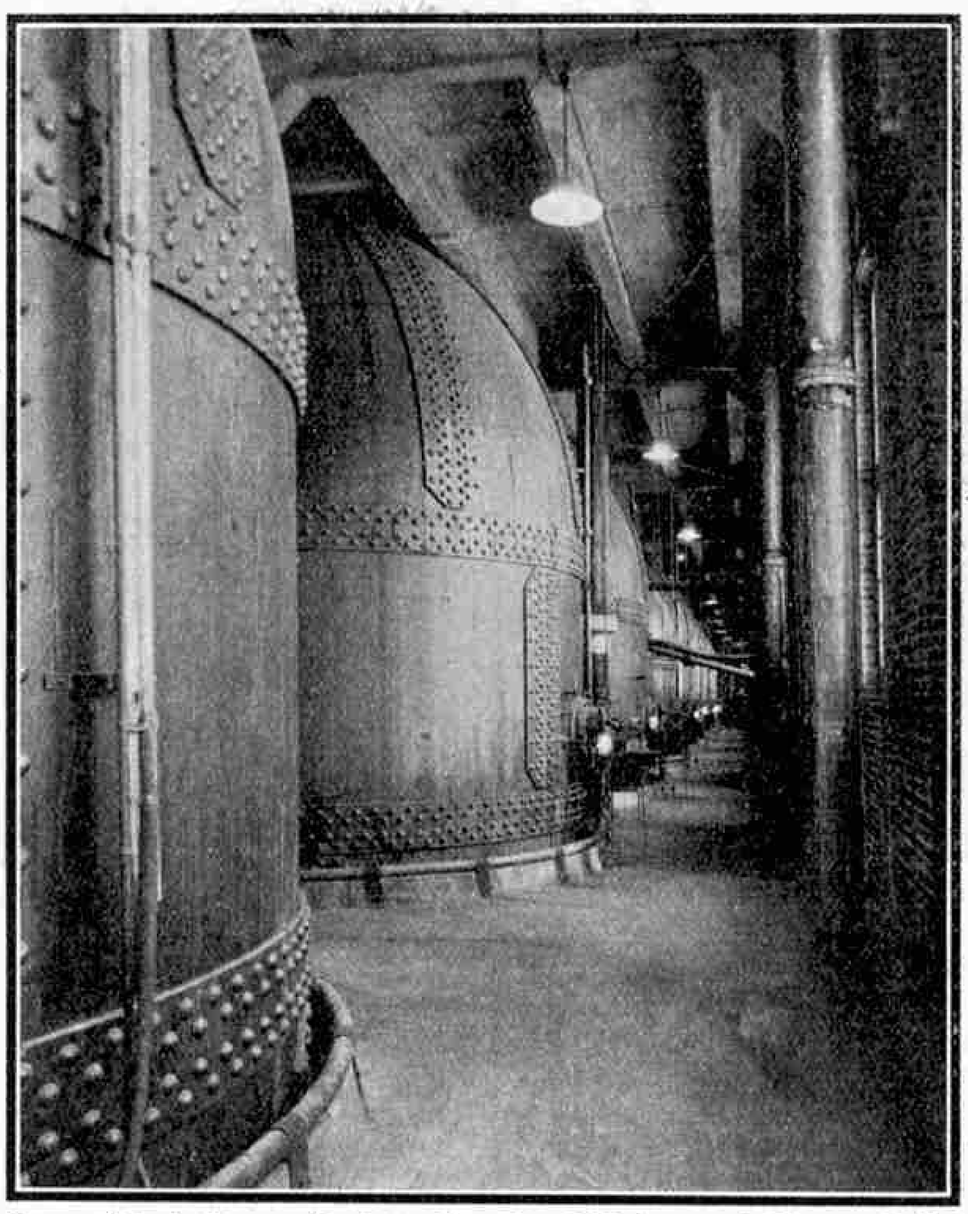
The spinneret may be regarded as the mechanical equivalent of the minute apertures fixed in the head of the silkworm. Instead of two such apertures, however, there may be 18 or more, spaced evenly on its surface. In shape the spinneret is like a caster, or a thimble with a flattened top, and it is made of the most expensive metal, platinum-iridium or platinum-gold alloy. The orifices are exceedingly fine, being drilled to sizes around .003 in. according to the denier required to be spun. A variation of even .001 in. is not permissible, such is the precision required in the making of the spinneret.

The streams of viscose, forced at a constant rate through the tiny holes drilled in the flange of the spinneret which, as used in the viscose process, is immersed in a bath that extends the whole length of the machine, are at once acted upon by a solution of sulphuric acid and water. To this solution may be added other substances likely to assist in neutralising the alkali contained in the viscose and "regenerating" the cellulose, that is, fixing or hardening it so as to form a filament.

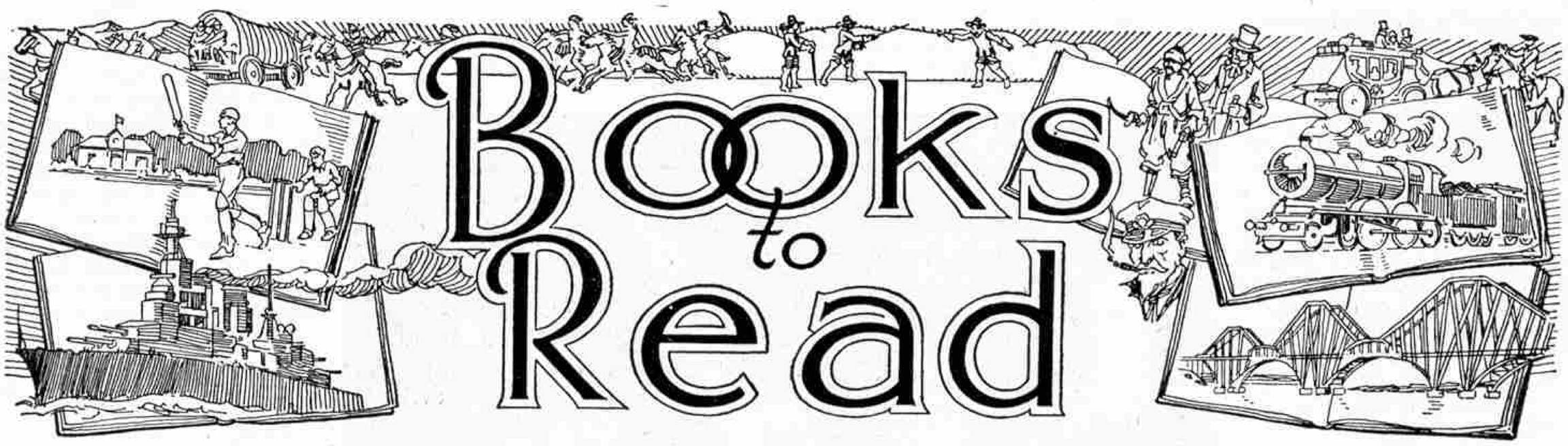
Without a pause the newly-formed filaments are drawn together and pass over the revolving glass wheel fixed at the top of the machine. They drop vertically from this point down a glass guide funnel leading to the spinning box. These boxes, which run at a speed of from 5,000 to 6,000 r.p.m. are made of aluminium, and are mounted loosely on a vertical spindle that may be driven either by friction, helical wheels, or by a separate motor. The boxes are from 6 in. to 6½ in. outside diameter, and are so arranged that they may be taken off the revolving spindle and replaced at any moment. Here and there on the surface of the boxes are drilled small holes so that the surplus acids still adhering to the threads may be thrown off by the centrifugal force generated.

It will be apparent that the whole mechanism connected with the spindle and spinning box must be perfectly balanced, and to this end the spindle has a certain amount of flexibility and is provided with a self-centring arrangement near its head. The head of the spindle is the only part visible, the shank, cone coupling, and helical driving wheels being enclosed within the casting, and the wheels running in an oil bath.

Into this rapidly rotating spinning box the correct number of filaments required to form a thread of a certain denier are conducted through the glass guide funnel, which also acts as a traverse motion. Immediately the filaments leave the funnel, which moves slowly up and down, they are drawn outward at right angles by the centrifugal force generated within the box, and by this means are twisted and wound, the number of turns per inch, usually two and a half, being regulated by the respective speeds of the glass roller and (Continued on page 340)



Some of the boilers on the lower floor, in which the wood chips are boiled or digested with chemicals and resolved into a pulp.



"Watermills and Windmills"

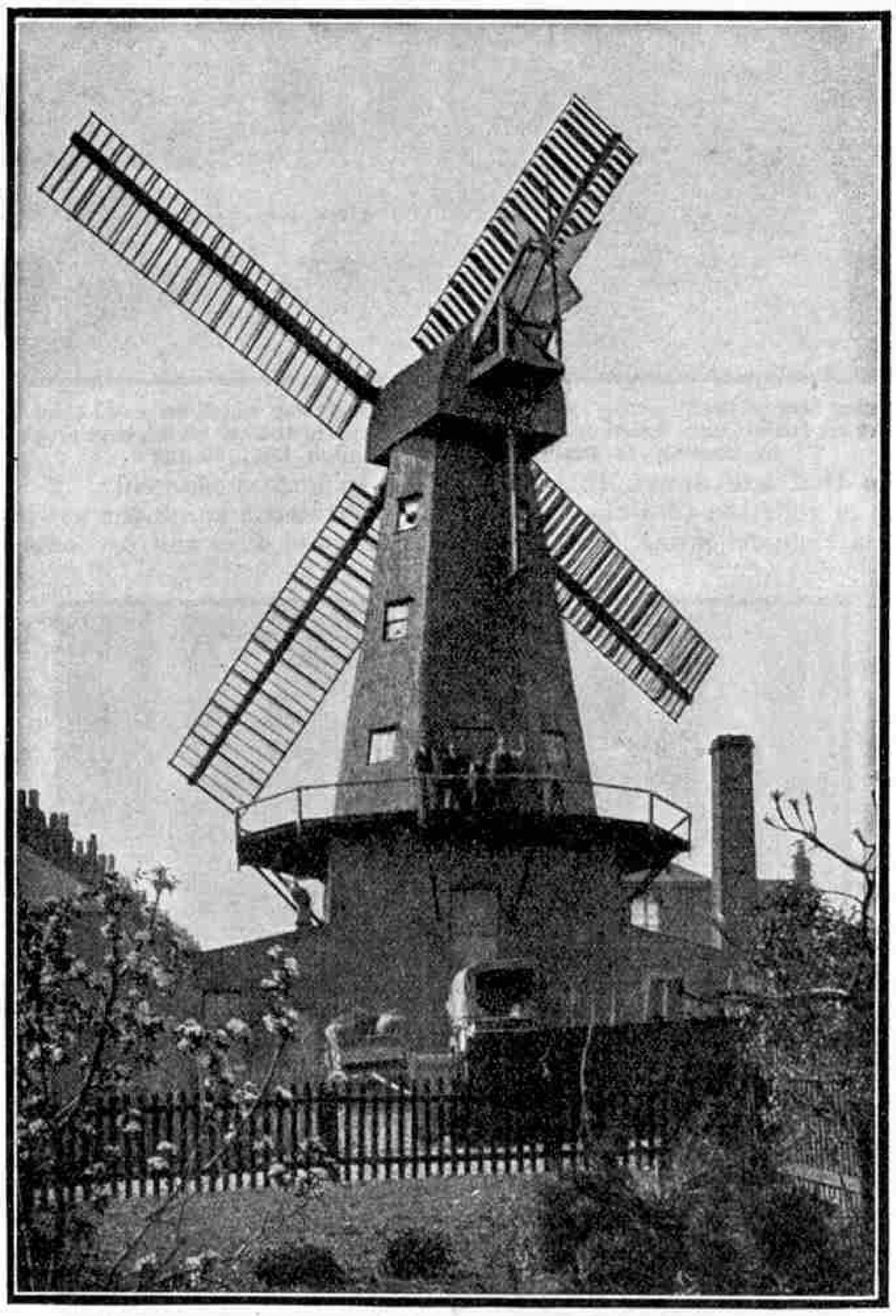
By W. Coles Finch. (C. W. Daniel Co. 15/- net)

Mr. Coles Finch, whose name is familiar to readers of the "*M.M.*" as the author of interesting nature articles, has produced many fascinating books on country life. In most of these he has touched upon the subject of corn, mills and millers, and the extensive knowledge of these topics that he revealed led to many requests that he should deal more completely with the mills of Old England. We can imagine that he needed little persuasion to take up this romantic subject, and the result is the present volume.

To deal fully with the story of watermills and windmills in Great Britain would be a tremendous task, and Mr. Coles Finch has wisely confined himself to a pictorial and historical record of happenings in Kentish corn mill land. He has gathered information from every available source, but has chiefly depended upon his own efforts, tramping over the county in search of lost mills and on visits to those still standing, whether in ruins or working intermittently, and talking over old times with veteran millers and millwrights. He has devoted many years to this task, and to that of obtaining as full a pictorial record of mill life as is possible in these days; and he writes about his experiences with care and accuracy, while retaining his pleasantly familiar style.

The story of mills begins very early, for the first mention of an Anglo-Saxon watermill is said to have occurred in a charter dated 664, while a century or two later astonishingly large numbers were at work. So many mills indeed are recorded in Domesday Book that the author wonders if rainfall at the time of the Norman conquest was more profuse than it is to-day, for he finds it difficult to believe that the rivers and streams of Kent could provide sufficient water, except at flood season, for the 351 mills then in existence on their banks! In the Middle Ages mills played an important part in the life of the country. Practically all were owned by the Lords of the Manor, who, if they were unscrupulous, could grind the faces of the poor while grinding their corn. That many of them were exacting is shown by the fact that in the revolt of the peasants in the time of Richard II prominence was given to demands for freedom to use handmills.

To-day practically all these ancient watermills are derelict, and in some cases a disused mill pond is the only reminder of their existence. When the author visited one mill that formerly had been among the most powerful in the county, he found that "a heavy fall of snow had crushed in a large portion of the granary roof and the floors were dangerously rotten. All the windows were smashed. Sparrows, starlings and other birds had taken possession of every available nook and ledge and were busy with their domestic affairs. The miller's house was completely gone, exposing to view the large iron breast-wheel, which stood between the mill house and the mill. Even the floors of the granary had been cleared away, while the waters of the Len poured over the weir past this scene of desolation and decay." Watermills still remain here and there of course, but they are of scant importance; and the old-time miller, regulating his ways by the volume of water flowing over his weirs, and awaking in the middle of the night if the roar of the stream told him that there was sufficient power to turn his millstones, is gone beyond recall.



Delce Mill, known also as Glover's Mill, a still active windmill in Rochester. From "Watermills and Windmills" reviewed on this page.

The windmill came about a thousand years after the watermill, the first undisputed reference to the existence of one of these giving its date as 1191. Mr. Coles Finch traces the history of these splendid old structures from the rude and primitive early mills to the post mills and tower mills that abounded in such numbers in the middle of the 19th century that England could have been described as under sail. Windmills were not easy or cheap to build, but they had long lives, for the old-time millwright was a clever craftsman, skilled in the delicate adjustment of the sweeps that turned in the wind, and of the heavy millstones. Kent seems to have been famous for its millwrights, and it is particularly interesting to read that last century one famous Kentish firm actually built a windmill at the foot of Mount Zion in Jerusalem.

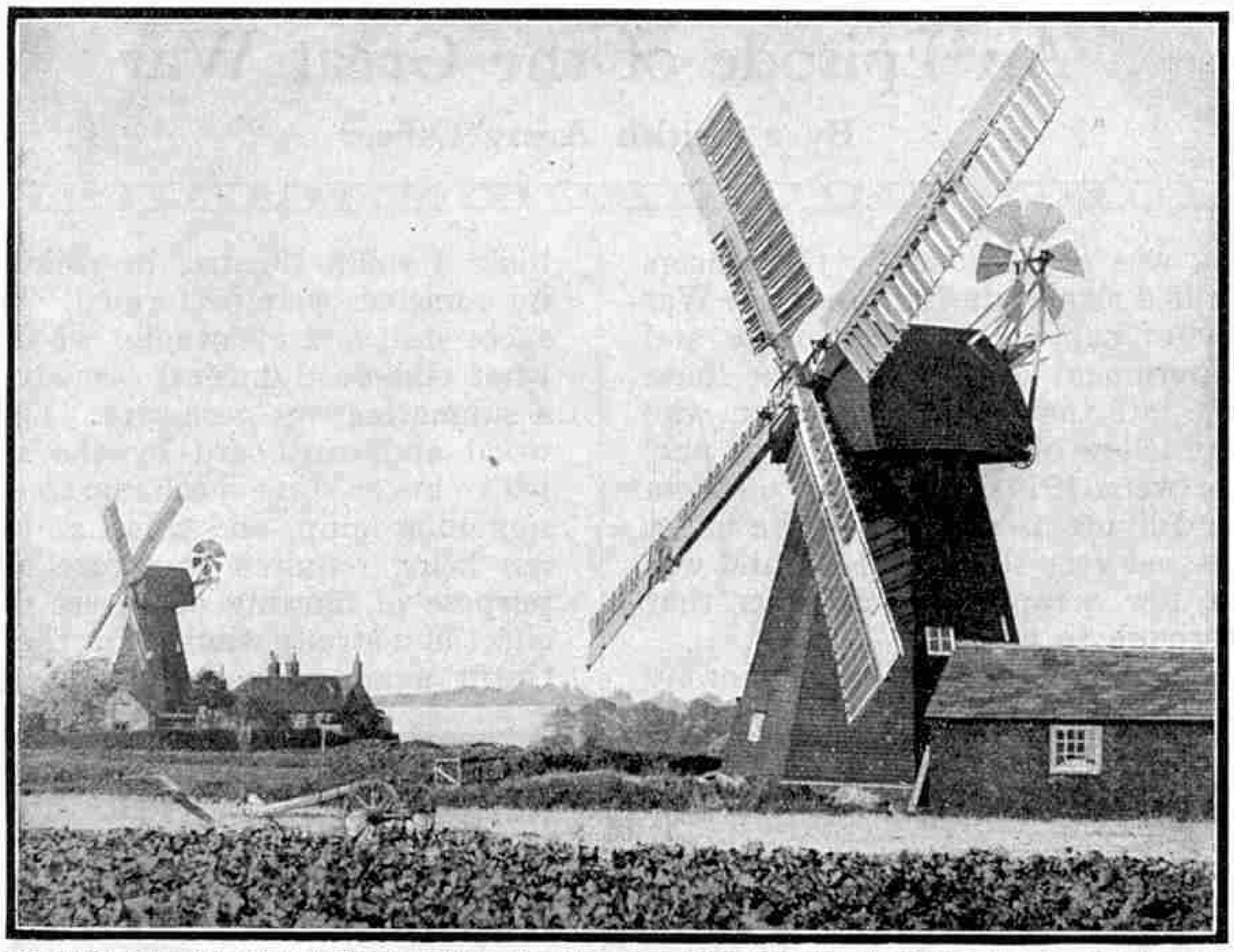
Many interesting stories are told of the working of windmills in the days when in every village the miller ranked second to the parson in social rank. This was natural when roads were bad and each village was self-contained, for the windmill then offered the only means of grinding the corn of the inhabitants. With the coming of hard roads farmers became less dependent on the neighbouring mill, and eventually the decline of British agriculture, and the growth of huge roller mills at our seaports, making flour from imported wheat, led to the decay of milling by wind and water power. Mr. Coles Finch traces this decay, while deploring it and dwelling with delight on the attractions of mill life and the skill of the craftsmen who carved the wonderful feathering on the heavy millstones; and his chapters on windmill life and lore are full of attractive anecdotes.

From the windmills Mr. Coles Finch turns to the corn they ground, and in an interesting chapter tells the story of wheat

from the days when it was first introduced into agriculture. One section deals with the constantly recurring story of the germination of wheat from Egyptian mummy cases, which is shown to be untrue, since the germ of a grain of wheat loses its fertility within about five years. The author then recalls the making of bread in the days before modern machinery was invented, and regrets the passing of the old English wholemeal loaf, which carried within it the vitamins and roughage on which food reformers now wax eloquent.

Finally the author comes to the chief purpose of his book—the compilation of a record of Kentish windmills of the great days of British agriculture. Each existing mill is carefully recorded, and interesting details of its history are given; and the author describes his efforts to trace the remains of mills shown in old maps, or mentioned in documents, but which have long since disappeared. No fewer than 410 windmills known to have stood in Kent between 1596 and 1930 are dealt with, and as many as possible of these are illustrated by an extensive collection of splendid photographs that add greatly to the value and attractiveness of the book.

There are 100 pages of art plates, including photographs of more than 200 mills and a large number of scenes connected with mills and milling history, many of which are rare and probably would have been lost but for Mr. Coles Finch's efforts. As far as possible the photographs of windmills are arranged in pairs, one showing the present condition of the structure and the other recalling the days when it was in full operation. Most of them are the work of the author himself. Others have been collected from friendly mill enthusiasts, from modern representatives of Kentish families of millwrights, and from old men who formerly worked in mills and still retain their affection for them.



Windmills formerly active at Eastry, Kent. One has now been demolished and the other has lost its sails. From "Watermills and Windmills" reviewed on the opposite page.

"Earth Lore"

By Professor S. J. Shand
(Thomas Murby & Co. 5/- net)

The author describes his book as "Geology Without Jargon," and it thoroughly deserves this description, for it gives a clear and accurate picture of the wonderful changes the Earth has undergone during its long history, and yet is as fascinating as a story book. Our globe is imagined as a great raft of earth floating in nothingness, and step by step we are led to the discovery that it is round, and not flat, as it must have appeared to early Man, and that we are able to travel at will over its surface because of some curious attraction that it possesses. Next we see how the stars can be used to find the size of the Earth and to enable us to form a true picture of its association with the Sun and the Moon and its position in the Universe, and we find that our planet and the system of which it is a part form only an insignificant speck in the ocean of space.

When measured on the scale necessary for dealing with the stars, the hills and valleys of the Earth seem to be only tiny wrinkles, and on a model of our globe 12 ft. in diameter even Mt. Everest would be represented by a ridge less than half an inch in height. These comparatively small features are big obstacles to us, however, and the face of the Earth presents many puzzles. For instance, most of the land is gathered together into the northern hemisphere, and practically every large mass of land is triangular and has water at its antipodes. It is also a little surprising to see how neatly South America would fit in to Africa if the two continents could be pushed together. In order to give explanations of these and other interesting features, the author shows us how to read the story of the rocks, and of the folding and other astonishing changes they have undergone in the millions of years that have elapsed since the Earth began to take shape.

This is not sufficient to provide solutions for the puzzles, however, and it also is necessary to turn to the part of the globe that lies beneath the thin crust on which we live. Then we make the surprising discovery that the continents are gigantic rafts floating on a magma, or thick fluid, formed by the melting of heavy rocks under great pressure, that only comes to the surface in volcanic outbursts and other great upheavals. More astonishing still, there are reasons for believing that the continents have slowly drifted from their original positions, and that South America and Africa once did fit in with each other. Both continents then seem to have formed part of a vast mass of land round the South Pole to which Australia, New Zealand, and India also then belonged. Why the continents have drifted in this manner is a problem that as yet is unsolved. The secret of this and other fascinating topics dealt with by the author lies deep in the Earth and will not be revealed until we know more of the magma that is beneath our feet.

The book contains four plates and 33 drawings that illustrate details of special interest in the fascinating story the author has to tell.

A veteran post mill at Rolvendon, near Cranbrook. The roundhouse was broken up and used for firewood during the Great War. (See above.)

"Instructional Play and Games for Scouts"

By K. C. Sparrow, B.Sc.
(Brown, Son & Ferguson Ltd. 1/6 net)

The number of books dealing with various features of scout work naturally is very large, for the scope and range of the movement is immense. Many of the volumes published show that the individuality of the keen Scoutmaster is given full play in the training of those in his charge, and Mr. Sparrow's original treatment of instructional play and games belongs to this class. His book explains in detail a carefully planned series of games that have been found helpful in Scout work. Some of these provide opportunities for the physical activity that is natural to all boys; others are designed to develop mental agility; and all are skilfully adapted to training in signalling, patrolling, ambulance work, tracking, and other branches of scouting.

Mr. Sparrow, who is a Meccano Club Leader as well as a Scoutmaster, has performed his task very thoroughly and his book will be a safe guide to all concerned with scout training. It contains a number of interesting half-tone illustrations in addition to useful diagrams.

Meccano in a German Prison Camp

An Episode of the Great War

By a British Army Officer

PROBABLY nothing was so dreaded by the officers and men of the Allied armies during the Great War as the possibility of capture by the enemy and imprisonment in an internment camp behind the lines. Unhappily this was the fate that befell the writer, who was confined with many fellow officers for the latter part of the terrible years between 1914-1918. Shut off from all our countrymen, and living as we were in the midst of our enemies, time passed very slowly indeed, and was only relieved by the few scraps of war news that occasionally filtered through to us.

In order to lessen the terrible and unbroken monotony of day after day of idleness and confinement, we decided to arrange among ourselves a series of lectures on various mechanical topics, and on account of my earlier training in the Army Service Corps as an instructor on motors, I was appointed "official" lecturer. Somehow or other I managed to obtain a blackboard and a supply of coloured chalks, and with these I was able to make large and elaborate drawings of the various parts of a motor car, in order to illustrate my lectures and make clear my explanations. A few of my companions were slightly acquainted with the principles of motors and were able to understand the various diagrams I drew, but the greater part of my audience experienced some difficulty in grasping the functions of the various mechanisms. I often improvised crude models by means of empty tins, a wooden pointer and a few books, but the usual result was a fervent wish that I had been provided by nature with three or four hands instead of only two!

This photograph was taken in a German prison camp theatre during the Great War. The propeller and other mechanical features of the submarine shown on the stage were constructed entirely from Meccano parts.

My delight can be imagined, therefore, when towards the end of the war, friends in England managed to send me a No. 6 Meccano Outfit. This soon put an end to all my troubles. I immediately constructed a large and very complete model of a motor car engine and chassis, with the result that mechanical movements that previously had taken considerable time and effort to explain were now clearly understood in a few minutes. Later the chassis was taken to pieces, and other models such as gear-boxes, differentials, brakes, etc., were made as required.

My Outfit also came in useful in various other directions of which the following is a typical example. Some time previously my fellow prisoners and I had built a small theatre, in which comedy plays written by ourselves were performed. The shows had been very successful, and eventually we decided to stage a somewhat elaborate musical comedy, in one scene of which a submarine was necessary. This was constructed from wood and cardboard by the stage carpenters, and it fell to me as stage mechanic to equip it with a propeller, signalling lamp, and a fan at the top of the mast, the fan being required to create a current of air for the purpose of blowing out a set of streamers to give the effect of a strong wind. For these purposes my Meccano Outfit again proved most useful, and I was able to construct these accessories very serviceably and realistically. The propeller, lamp and fan were all worked by one man concealed inside the submarine. The photograph reproduced here will give an idea of what the vessel looked like. The submarine worked splendidly and the show was a great success.

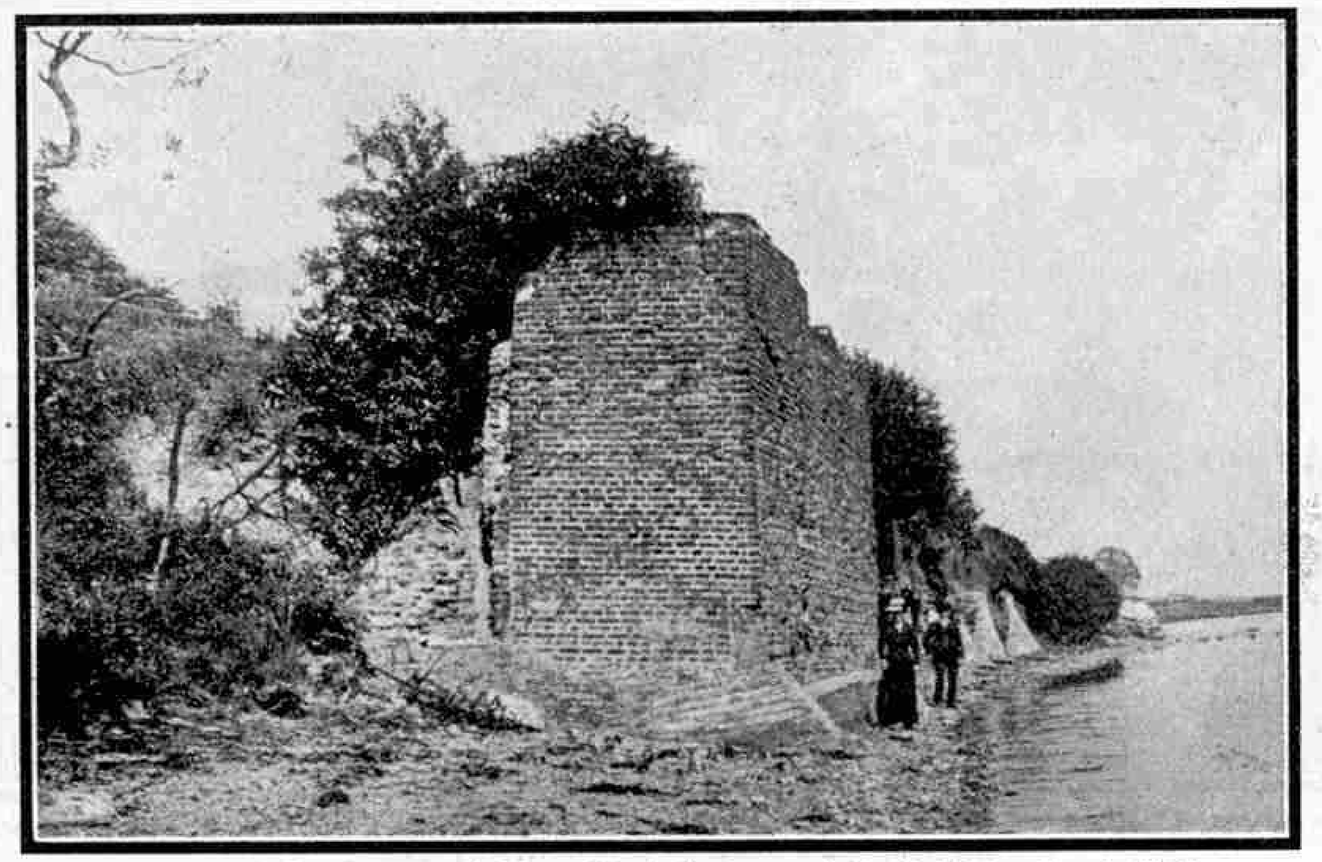
The most novel use of Meccano was demonstrated in another prison camp towards the end of the war. In this camp the prisoners had been planning for months to escape by means of digging a long tunnel, on which they had been working with the greatest secrecy and precaution. As the boring progressed it was found very difficult to provide adequate ventilation for those working far down the tunnel, and although perpendicular air shafts were bored upward, so as to come to the surface in the middle of bushes, the problem was to exhaust the bad air in the tunnel and suck in fresh air. Eventually the difficulty was overcome by means of Meccano. An Outfit belonging to one of the officers was called into service and a huge fan was constructed, and by using suitable Sprocket Gearing it was possible to drive the fan at such a rate that an officer sitting in the tunnel had only to turn the handle at a comfortable speed to set up a good draught! The contrivance fulfilled all the demands made on it, and readers will be interested to know that as a result of this simple Meccano model the tunnel was completed and many of the prisoners escaped.

It would take more space than I am allowed to describe the many other occasions on which Meccano proved useful, but the few instances I have mentioned are sufficient to show that even in the Great War, Meccano played a part, and played it well!

The Dutch Fleet in the Medway

By W. Coles Finch, M.Inst.C.E.

BY the shore of the Medway, in Short Reach, stand the ruins of Cockham Wood Battery. From here in days gone by the guns replied feebly to those of the Dutch invader, and all who are interested in these old-time works of defence should see the little that remains, before all disappears. To-day parts of the massive walls of the fort stand, reminding us of the troublous past; but the lapping and fretting of the tides during the past 250 years have been undermining them, and they are falling into the river. Those in search of mementoes of the period have likewise destroyed the interior of this ancient battery, its magazines and gun pits, and the arches carrying the gun platform; of all these little now remains. Even since the accompanying pictures were taken further havoc has been wrought, and the ruins are likely to disappear before long.

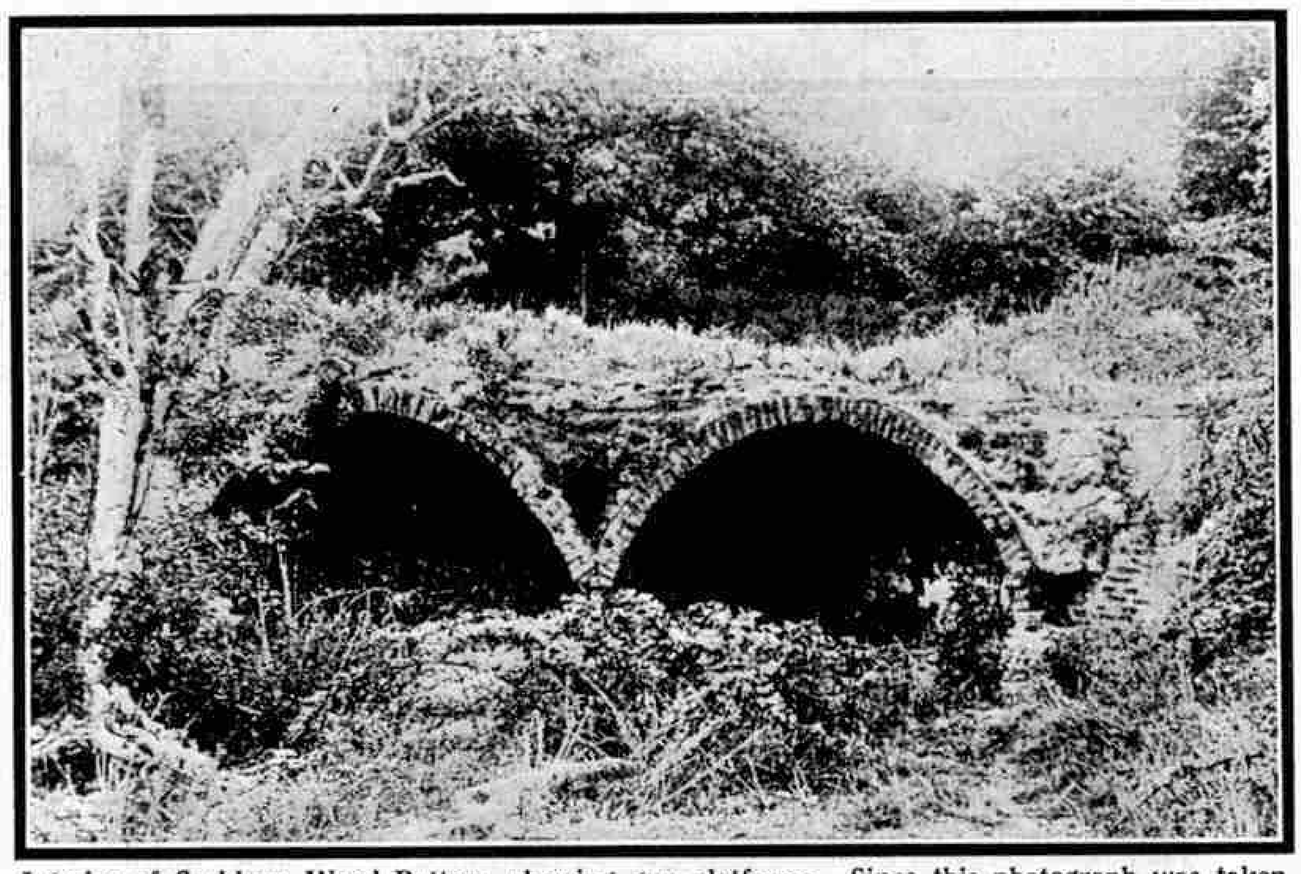


Ruins of old Gun Battery, Cockham Wood, that opposed the Dutch invaders in 1667.

History records how, 265 years ago, the nation was humiliated. The enemy's fleet blockaded our rivers, proceeded as far as Chatham, and there sank and burned the British men-of-war that lay at anchor in absolute unreadiness.

The growth and development of Dutch antagonism, and the struggle for the control of the seas, is well known. Finding that we were deluded into a false sense of peace and security, the Dutch admiral De Ruyter put to sea on 4th June, 1667, with a fleet that included 54 ships of the line. Two days later he was joined by reinforcements that increased his fleet to 64 ships of the line and frigates, seven armed despatch yachts, 15 fire ships and 13 galliots, mounting 3,330 guns, and with 17,416 officers and men.

On 7th June the Dutch anchored at the mouth of the Thames, where they held a council of war; and on the 10th they bombarded Sheerness fort at the mouth of the Medway, which surrendered after the attack had been in progress only 1½ hrs. The capture of Sheerness created great consternation, especially at Chatham, farther up the river, and troops commanded by the Duke of Albermarle were hurried there to ward off the anticipated Dutch attack. Albemarle sank some ships below Gillingham, stretched a strong iron chain across the river just above the sunken wrecks, and set up a shore battery at each end of the chain. In case the Dutch should penetrate this defence he moored three large ships in positions that would enable their broadsides to be trained upon the enemy as they broke through the chain.



Interior of Cockham Wood Battery, showing gun platforms. Since this photograph was taken these ruins have disappeared.

The Dutch moved up the Medway on 12th June. The main body of the fleet was preceded by a squadron led by two fireships, and one of these broke the chain, while Captain van Brakel, in the "*Schiedam*," succeeded in boarding the English ship "*Carolus Quintas*," and by using her guns soon silenced the shore batteries. Some Dutch troops were then landed and they managed to blow up the magazine attached to one of the batteries. The battle that developed was very one-sided, as none of the English ships in the Medway was fully manned. Many of them were partially dismantled and some were actually laid up. The Dutch captured the "*Royal Charles*," of 90 guns, and burned the "*Royal James*," the "*Royal Oak*" and the "*Loyal London*." These were all flagships, the finest in the Navy, and had only recently carried admirals' flags at sea. After pursuing their work of destruction of our warships to the bitter end, the Dutch withdrew to the mouth of the river, continuing their blockade, and preying on the English commerce in the Channel until 26th July, 1667, when their marauding operations ceased.

A Unique Village in Miniature

Bekonscot and its Model Railway

THE curious fascination of the miniature seems to be felt by all, young and old alike. Even the everyday things with which we are so familiar that we scarcely notice them take on a new interest when we see them reproduced in model form. Miniature structures no doubt appeal to different people in different ways—to some, for instance, the craftsmanship displayed is the outstanding feature; but generally it may be said that the fascination lies mainly in the fact that models enable us to grasp, as a complete whole, schemes that we can only see in part in actual life. The miniature village of Bekonscot, with its railway line and surrounding country, makes an instant appeal to the visitor, largely because even the first glance reveals so much in such small space. He sees, in fact, exactly what a modern Gulliver would see if he could look down on a typical English village and its pretty surrounding district.

One station of "Bekonscot" model village and the neighbouring buildings. The miniature shops, houses, and trains are a source of great interest to visitors.

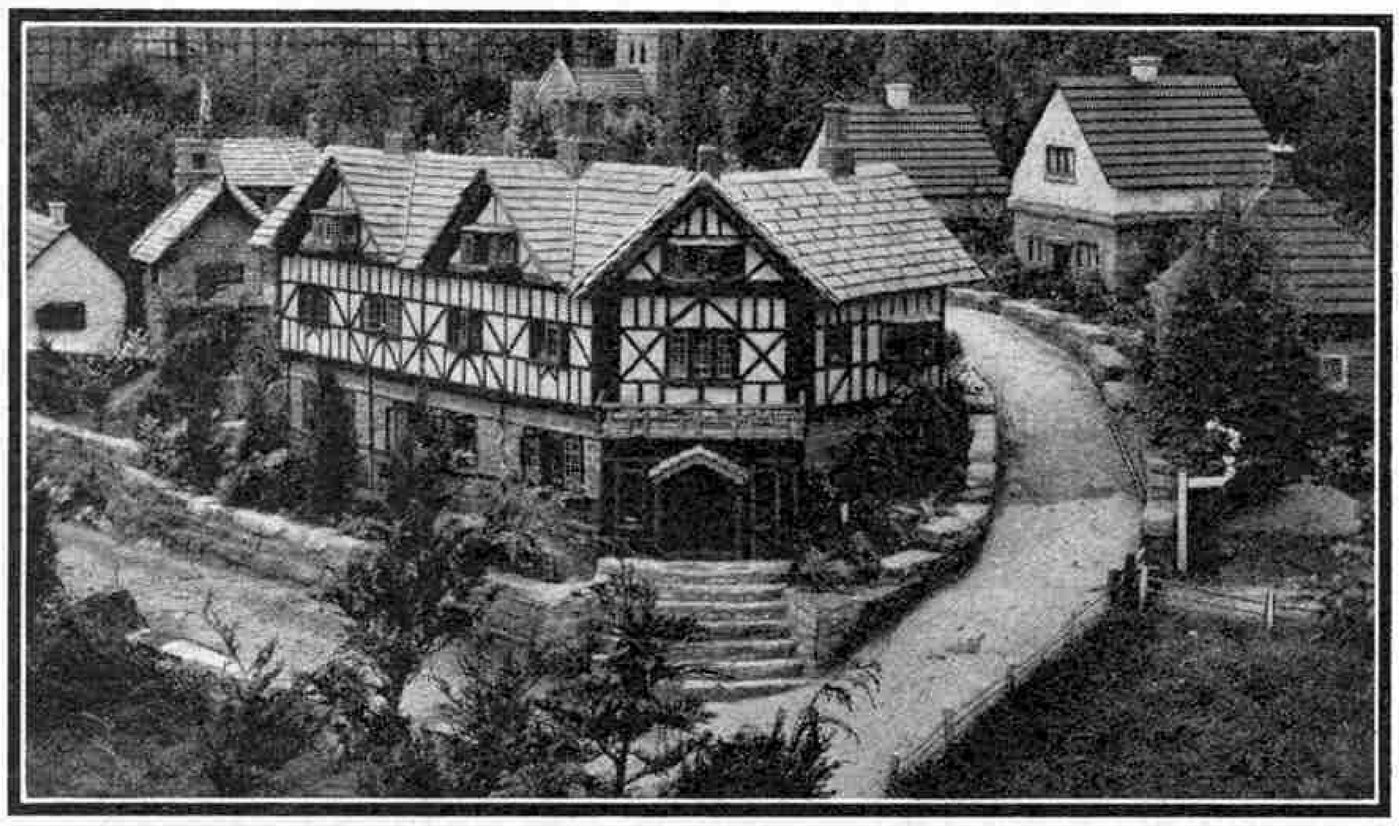
Bekonscot is situated on the estate of Mr. R. Callingham at Beaconsfield, and it reproduces with wonderful fidelity the characteristic features of this delightful Buckinghamshire village. Mr. Callingham commenced the construction of his model village some five years ago, with the object mainly of giving expression to his keenness and skill in landscape gardening. The village therefore is an ideal one, and it illustrates clearly how modern building schemes can be developed in keeping with beautiful natural surroundings, and without introducing any of the hideous villas and bungalows that are now so rapidly ruining many parts of the English countryside. The railway system was added after part of the construction had been carried out, so that, as in actual practice, the surveying and planning of the line had to be carefully carried out with regard to the natural obstacles. For this reason the railway has a particularly natural appearance, not merely on account of its surroundings, but even more as a result of its position in relation to the various features about it. Quite clearly the scenery has not followed the railway, as is the case with most miniature layouts on such a scale; on the other hand, the railway has followed the scenery, which is the logical thing for any railway to do.

A miniature church in the most natural surroundings. This Early English structure is built of real stone and is actually complete with stained glass windows.

The village is situated in a beautiful rock garden covering an area of roughly 1,000 sq. yds., and it consists of the village, with church, shops, hotel and other public buildings; 1,200 ft. of railway line, complete with rolling stock and a variety of accessories, and with five stations; fields, water courses and woods. The construction is carried out on a scale of one inch to the foot, and the result is a most remarkable achievement, which must be seen to be fully appreciated. Photographs can convey a fairly adequate idea of different sections of the scheme, but they utterly fail to convey the peculiar "atmosphere" of the village. Foreign visitors to England, who have the time and inclination to leave the beaten track and pass through the real heart of the country, are always impressed by the fact that each country village seems to have its own distinct individuality. In some curious way Bekonscot also has acquired a personality of its own, which only a visit can reveal.

The dominating feature of the village is the Church, situated just off the High Street. This is a little masterpiece of Early English architecture, complete with stained glass windows. As one passes by, a peal of bells may be heard from the tower, or perhaps the organ may be playing and the choir singing. The effect is beautiful and rather uncanny; and it is just a little disappointing to learn that the effects are produced by relaying gramophone records of bells and organ and choir music from the power station that supplies the railway system.

Other notable buildings are the Town Hall and the Post Office, and the "Saracen's Head" Hotel built in the half-timbered Tudor style. In front of the hotel, and approached by a steep incline from the station, is the lake with its two islands, its light-house and pier. On the pier is a pavilion that seems to call for a band, and sure enough at times concerts are held there, produced by the same means as the music in the church.

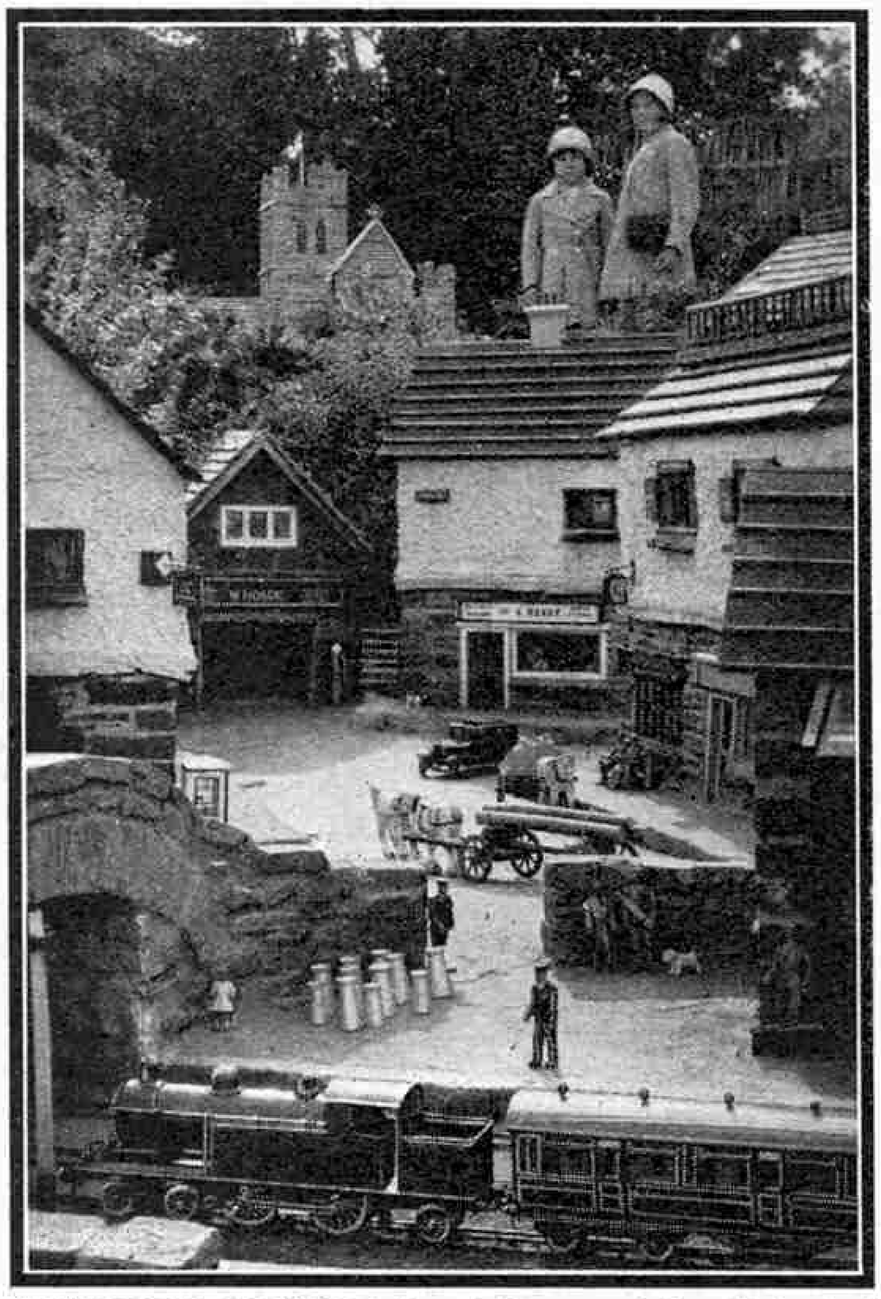


One corner of the village showing various miniature houses. The fine half-timbered hotel in the foreground is a very effective piece of model work.

Leaving the streets with their fascinating little shops, many of which bear the names of Beaconsfield shop-keepers, one comes to the outskirts of the village, in which picturesque residences are scattered about the fields and woodlands. Dwarf conifers are conspicuous, and here and there brilliant flowers give a touch of colour to the scene, which is reflected in the green water of the lake. Bridges span the space between the mainland and the islands. The village is electrically lighted, and in the evening forms an indescribably charming picture.

During the present winter season there has been added a Road House complete with verandah, restaurant, sun-bathing slopes and swimming pool, and several other smaller changes have also been made. Other new features will be added from time to time, and in particular we understand there is a rumour that curative waters have been discovered on the site, and that therefore the village at Bekonscot may ultimately become a Spa where the "small people" will gather to drink the waters!

There is no "jerry building" at Bekonscot. All the buildings are made to stand the ravages of the weather, and stone, brick, slate and cement are the main materials employed. Some of the roofs of the buildings are sheathed with lead, and pitch roofs are correctly tiled, either with oak weather-boarding or with asbestos tiles on proper rafters. Oak scantlings are pegged together for the beams, and the spaces between them are filled with real soft bricks, which have lines cut in them to represent scale-size bricks. Many styles and types of buildings are included, so that while each one blends harmoniously with the general scheme, there is no monotonous repetition.



A view of one end of the station platforms, and the village street beyond with its realistic shops and traffic.

The main roads through the village are equipped with miniature automatic traffic signals; telephone and post boxes are provided, and sign posts indicate the various roads. Visitors need feel no nervousness in walking through the village, for all the roads and bridges have been constructed to bear the weight of adults with safety.

The railway is laid to a gauge of $1\frac{3}{4}$ in., and the permanent way consists of properly chaired and sleepered track correctly laid on a well-ballasted road bed. It is very completely equipped, and represents an up-to-date main line connecting the Bekonscot district with the imaginary London terminus of Maryloo. This terminus has three main platforms, which are complete with all the usual offices. The whole of the 1,200 ft. of track is electrically operated by steam outline trains of various types. Double track is available throughout, with numerous points, crossings and connections, and the whole line is protected by three-aspect colour-light and other signals. The track is being continuously overhauled and improved and it is hoped that the small alterations in the general electrical system will facilitate the running of the trains during the coming season.

Mr. Callingham has generously made his charming village available to the general public. Bekonscot is always open to visitors and it is hoped to run the trains (weather permitting) every Sunday, Bank Holiday and the first Saturday in each month from April to September, from 2 p.m. until dusk. The gardeners have instructions to show visitors round at any time during the rest of the week, although it is unlikely, except on special occasions, that the train service will be operated apart from the days mentioned. A charge of one shilling for admission is made, and after all the expenses and Entertainment Tax (if any) have been paid, the balance of the funds will be given to various charitable organisations.

Bekonscot is situated in Warwick Road, Beaconsfield, and is about three minutes' walk from the north side of the local station on the Great Western and London and North Eastern Joint Line. Travellers by road will be interested to hear that it can be conveniently approached by car from the Beaconsfield cross-roads where the main road from London passes the church, a distance of about $1\frac{1}{2}$ miles.

Interesting Three-Wheeler Cars

Meccano Combined with No. 2 Motor Car Outfit

THREE-WHEELERS form a distinct class of road vehicle. In outward appearance they resemble small cars, but in many mechanical details they follow closely motor cycle practice. For taxation purposes they are classed with motor cycle combinations, and this point alone makes them very popular, as they provide car comfort at a running cost only slightly higher than that of a motor cycle outfit.

Sports Model Morgan

The Morgan is probably the best-known three-wheeler, and several different types are to be seen in daily use. The chassis generally consists of tubular members and is fitted with a V twin engine of orthodox motor cycle design. The engine may be air-cooled or water-cooled, and in some cases an "in-line" type of water-cooled engine is fitted. In some models the drive is taken to a clutch unit that can be engaged with either of two sprockets driving, by means of chains, sprockets of different sizes placed one on each side of the single rear wheel. The touring models have the engine mounted beneath the bonnet, but a notable feature of the sports models is the placing of the engine outside in front of the bonnet. It is this type of Morgan three-wheeler that is shown in model form in Fig. 1.

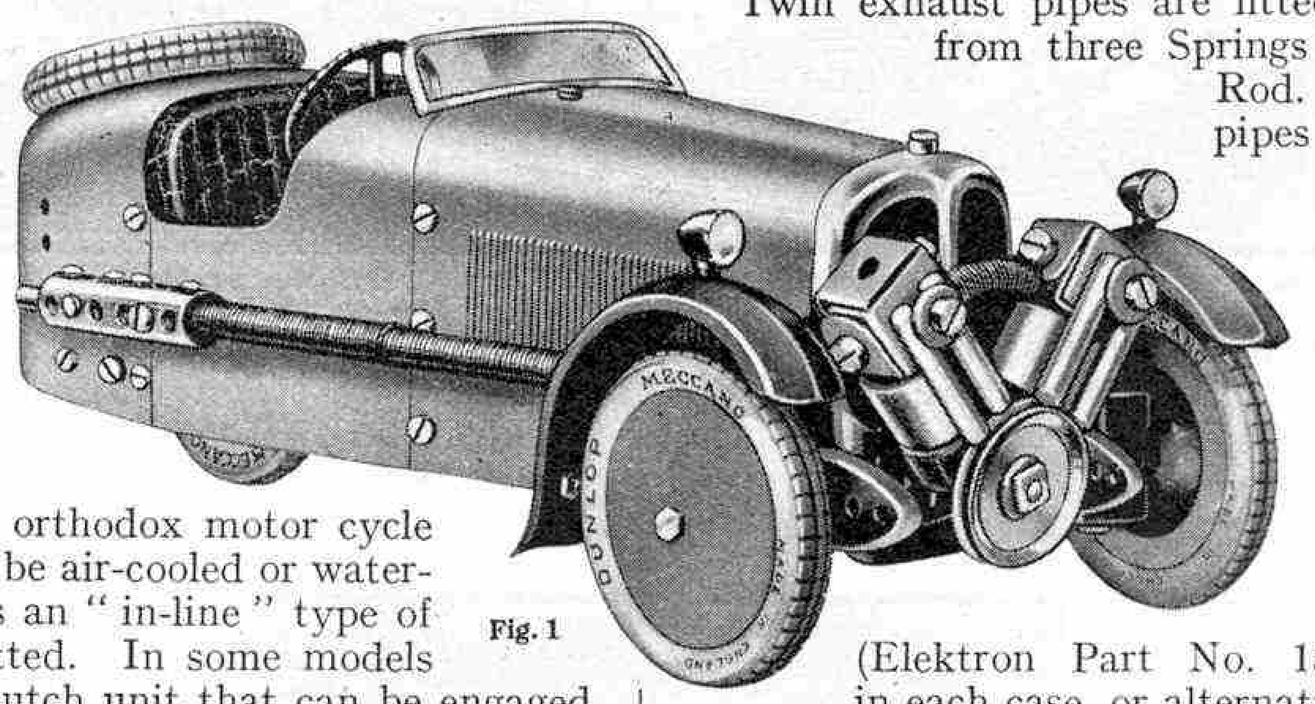


Fig. 1

The general construction of the body is the same as that usually followed for building the Meccano No. 2 Motor Cars, but in assembling the front portion the Bumper and front Number Plate Bracket are omitted, and the Rear Mudguards, Clockwork Motor and Wheels are also left off. The Wind Screen is not fitted in its usual position but is secured in the hole nearer the front, by one of the bolts that hold the Bonnet and Dash Sections together. The Front Mudguard Tie Rod and Headlamps are omitted.

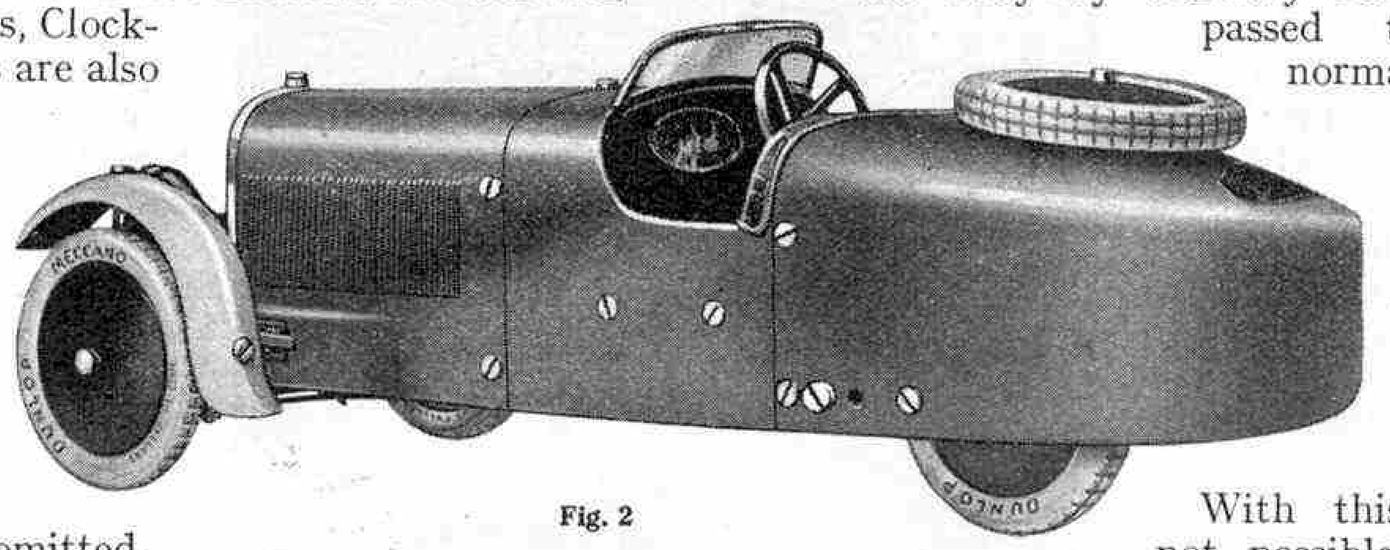


Fig. 2

The V twin engine is of the water-cooled type with overhead valves. It is built up by mounting a 1″ Fast Pulley on a 1″ Screwed Rod and securing on the same Rod two Angle Brackets, each carrying further 1″ Screwed Rods to which the cylinders are fitted. The cylinders each consist of a Chimney Adapter rigidly secured on its Rod by two nuts, and the casings for the overhead valve operating gear are represented in the model by Double Brackets. For the push rods that operate the valves 1″ Axle Rods are used, and are clamped in position by means of $\frac{3}{8}$″ Bolts fitted with Washers.

The engine is completed by fitting the inlet pipe, and for this a short length of Spring, cut from Part No. 43, is bolted between the two cylinders as shown. The Radiator with curved sides (Part No. A1001) is used in this model, and the engine is attached to this by inserting the Screwed Rod through the hole in the radiator and securely fixing it by means of a Nut.

Twin exhaust pipes are fitted and are each formed from three Springs placed over a 5″ Axle Rod. The front ends of the pipes are attached to the upper Front Mudguard Brackets in the holes where normally the Headlamps are fitted. The ordinary Motor Car nuts are unsuitable for fixing these, as there is a tendency for them to slip through the holes in the Springs. A Square 6 B.A. Nut (Elektron Part No. 1583) is therefore used in each case, or alternatively a Meccano Washer may be put on each bolt before fixing.

Silencers are fitted on the ends of the pipes and each consists of two Couplings. A $1\frac{1}{2}$″ Axle Rod holds the two Couplings together and protrudes from the rear end of the silencer so formed. The 5″ Rod on which the Springs are mounted is inserted into the forward end of the silencer, and a $\frac{1}{2}$″ Bolt (No. A1056) is inserted through the centre transverse hole of the forward Coupling and secured to the body by two nuts. Two $\frac{1}{2}$″ Reversed Angle Brackets are secured inside the body by ordinary Meccano bolts that are passed through the holes normally occupied by the rear axle. The Brackets point towards the rear and carry a 2″ Axle Rod on which the single Rear Wheel is mounted. Collars retain the Rod in position.

With this arrangement it is not possible to fit a Clockwork Motor, and the Rear Undershield Section cannot be fitted, but the Forward Section is secured in the usual manner.

Parts required for Sports Model Morgan: Motor Car Parts—
1 of No. A1001; 1 of No. A1005; 1 of No. A1006; 1 of No. A1008; 1 of No. A1010; 1 of No. A1012; 1 of No. A1015; 2 of No. A1020; 2 of No. A1025; 1 of No. A1026; 1 of No. A1028; 1 of No. A1029; 1 of No. A1031; 1 of No. A1032; 1 of No. A1034; 2 of No. A1035; 3 of No. A1037; 1 of No. A1038; 1 of No. A1045; 1 of No. A1046; 2 of No. A1052; 2 of No. A1055; 3 of No. A1056; 2 of No. A1057; 4 of No. A1058; 1 of No. A1064; 2 of No. A1065; 1 of No. A1066; 2 of No. A1069; 2 of No. A1071; 1 of No. A1072; 2 of No. A1073; 1 of No. A1075; 18 of No. A1076; 33 of No. A1077; 6 of No.

A1082 ; 1 of No. A1086 ; Meccano Parts—6 of No. 11 ; 2 of No. 12 ; 2 of No. 15 ; 1 of No. 17 ; 2 of No. 18a ; 4 of No. 18b ; 1 of No. 22 ; 6 of No. 37 ; 14 of No. 37a ; 2 of No. 38 ; 7 of No. 43 ; 4 of No. 63 ; 3 of No. 82 ; 2 of No. 111c ; 2 of No. 125 ; 2 of No. 164. Elektron Parts—2 of No. 1583.

B.S.A. Type Tourer

An outstanding feature of the B.S.A. three-wheeler is the front-wheel drive. The engine is mounted under the bonnet and is built as a unit with the gear-box and differential. The chassis is in the form of a Y, the stem of which is a tubular element, the arms being of channel section and supporting the engine. At the rear end a fork piece carries a pivoted arm, the outer end of which supports the rear wheel spindle. The inner end of the arm is extended by a leaf spring that is anchored inside the tube.

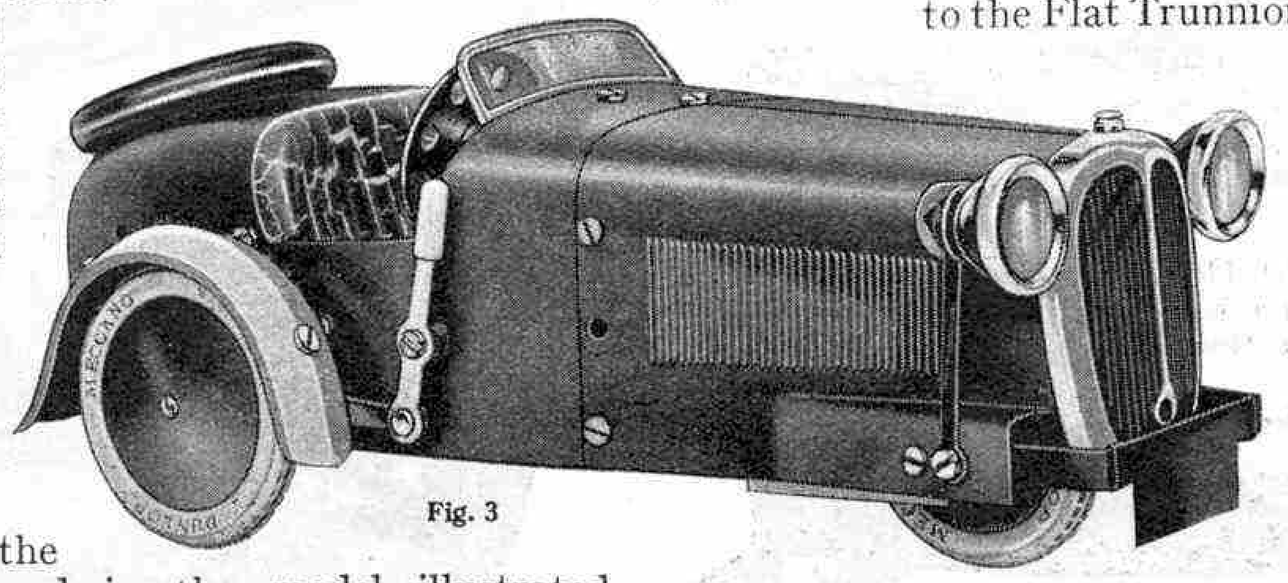


Fig. 3

The general outline of the B.S.A. is closely followed in the model illustrated in Fig. 2, the construction of which does not differ very much from the ordinary models. The Radiator with parallel sides (No. A1000) is fitted, and the tapering Rear Section (No. A1016) conforms with the lines of the actual car. Headlamps only are fitted, as in the prototype ; and to preserve the neatness of appearance, both in this and the model already described, the number plates have been omitted. Actually the number plates are fitted at the extreme rear of the body, but this cannot be done in the models. Reversed Angle Brackets carry the rear axle and are arranged in a similar manner to that described above for the Morgan. Also the front Undershield only is fitted.

Parts required for B.S.A. Type Tourer : Motor Car Parts—1 of No. A1000 ; 1 of No. A1004 ; 1 of No. A1006 ; 1 of No. A1008 ; 1 of No. A1010 ; 1 of No. A1012 ; 1 of No. A1016 ; 2 of No. A1020 ; 2 of No. A1025 ; 1 of No. A1026 ; 1 of No. A1027 ; 1 of No. A1028 ; 1 of No. A1029; 1 of No. A1031 ; 1 of No. A1032 ; 1 of No. A1034 ; 2 of No. A1035 ; 3 of No. A1037 ; 1 of No. A1038 ; 1 of No. A1045 ; 1 of No. A1046 ; 2 of No. A1051 ; 2 of No. A1055 ; 1 of No. A1056 ; 2 of No. A1057 ; 4 of No. A1058 ; 1 of No. A1064 ; 2 of No. A1065 ; 1 of No. A1066 ; 2 of No. A1069 ; 2 of No. A1071 ; 1 of No. A1072 ; 2 of No. A1073 ; 1 of No. A1075 ; 20 of No. A1076 ; 33 of No. A1077 ; 6 of No. A1082 ; 1 of No. A1086. Meccano Parts—1 of No. 17 ; 2 of No. 37 ; 2 of No. 125.

Raleigh Type Three-Wheeler

The new Raleigh three-wheeler was dealt with on page 197 of last month's "*M.M.*" It differs considerably from previous types in having the single wheel at the front and the two rear wheels driven in a similar manner to the majority of motor cars. In general body design the Raleigh closely resembles an ordinary sports car, except for the single front wheel, and of course the absence of external front mudguards. The chassis is of entirely new design, however, each side member being in the form of a letter "L," the long arm forming the actual side member and the short arm being arranged vertically at the front.

In the model, Fig. 3, the chassis side girders are formed from $5\frac{1}{2}$" Slotted Strips carrying at their forward ends 2" Strips secured at right-angles by means of 1" Corner Brackets. This construction is shown in the underneath view in Fig. 4. The upper ends of the 2" Strips are connected by a $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip to which a Flat Trunnion is bolted. The forks are formed from a pair of 2" Strips attached to a Double Bracket pivoted to the Flat Trunnion. A 1" Axle Rod supports the front Wheel, which is spaced by means of Washers.

Instead of the usual Steering Wheel and Column a $4\frac{1}{2}$" Screwed Rod is used, and carries at its upper end a Bush Wheel that is fixed by two Nuts. The Sleeve is then fitted on the Rod before the latter is passed through the hole in the Instrument Board and fitted with a loose Collar and two nuts locked together to retain the Rod in position. The lower end of the Screwed Rod is passed through the transverse bore of a Threaded Boss attached to an Angle Bracket pivoted to the forks as shown.

In Fig. 4 the bonnet is shown removed so that the construction can be seen more clearly. When this is fixed in position the $\frac{1}{4}$" Bolts that pass through the lower holes and the chassis side members each carry two Insulating Washers (Elektron Part No. 1570) placed between the chassis girders and the body.

Power for the drive is supplied by a Clockwork Motor mounted in the usual way, as shown, and the brake drum is also fitted to the offside rear wheel. It will be found that the model has insufficient weight at the front to counterbalance the weight of the Motor. To overcome this two 50 gramme Weights are mounted inside the bonnet by means of $\frac{1}{4}$" Bolts, and these keep the front wheel on the ground.

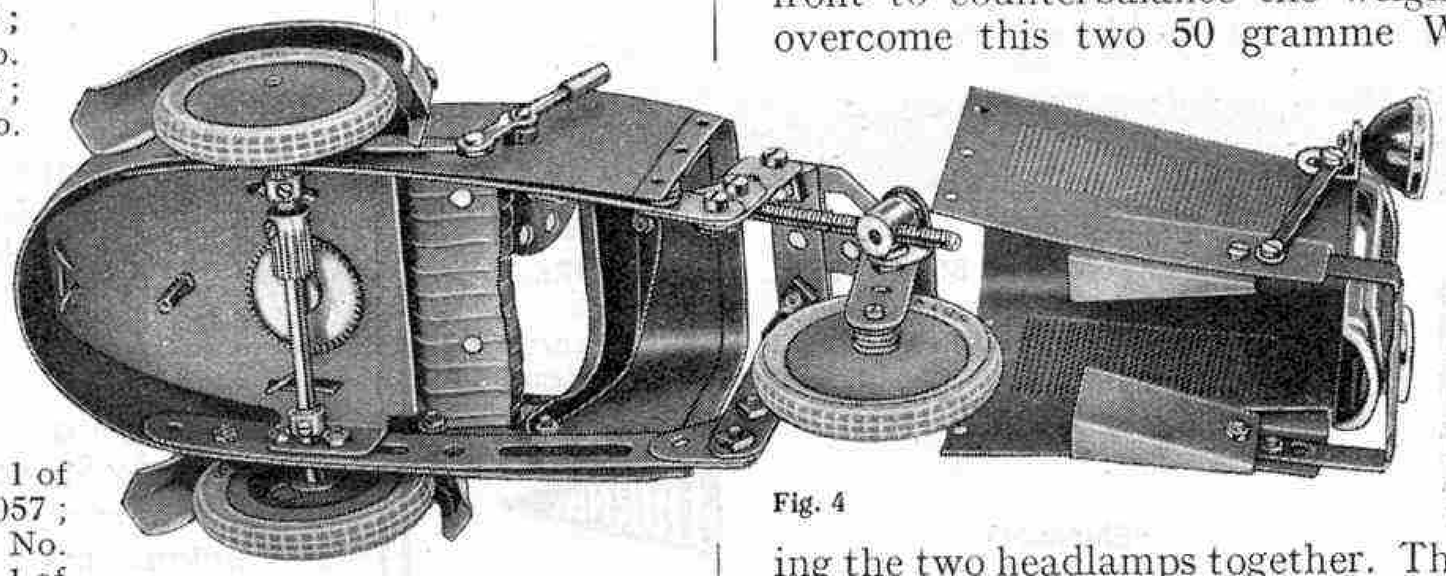
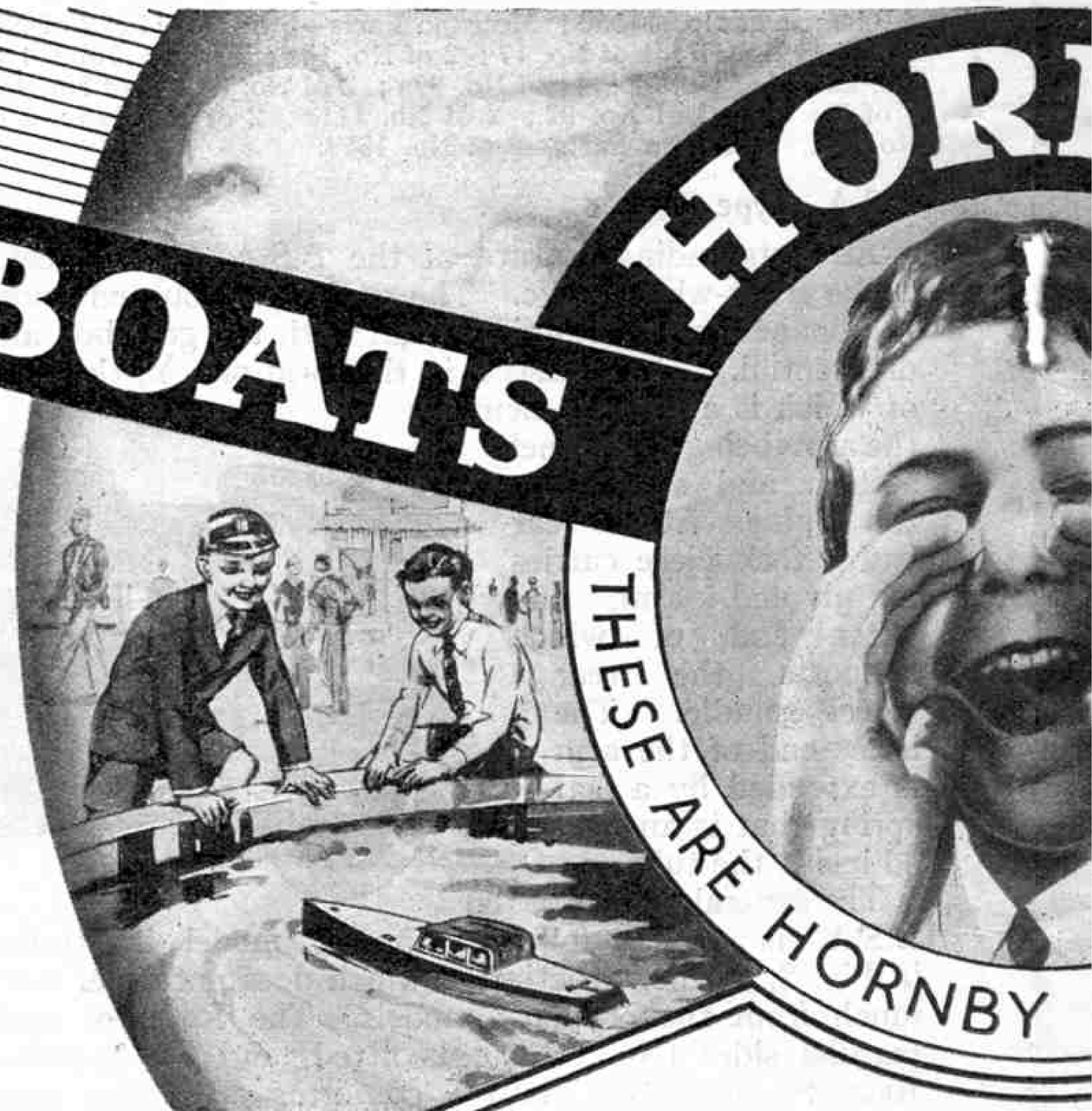


Fig. 4

The headlamps are mounted on Angle Brackets carried on the upper ends of Tie Rods that are normally used for connecting the two headlamps together. The Motor Car Nuts and Bolts are too small for the standard Meccano holes, and a fibre Washer is placed behind each nut. The lower part of the Radiator is pulled outward to produce the sloping front characteristic of the actual car.

Parts required for Raleigh Type Three-Wheeler : Motor Car Parts—1 of No. A1001 ; 1 of No. A1005 ; 1 of No. A1006 ; 1 of No. A1008 ; 1 of No. A1010 ; 1 of No. A1012 ; 1 of No. A1015 ; 2 of No. A1022 ; 4 of No. A1024 ; 2 of No. A1027 ; 1 of No. A1031 ; 3 of No. A1037 ; 1 of No. A1040 ; 1 of No. A1041 ; 1 of No. A1043 ; 1 of No. A1044 ; 1 of No. A1045 ; 1 of No. A1046 ; 1 of No. A1050 ; 2 of No. A1051 ; 1 of No. A1056 ; 3 of No. A1057 ; 3 of No. A1058 ; 1 of No. A1060 ; 1 of No. A1063 ; 1 of No. A1064 ; 1 of No. A1070 ; 1 of No. A1074 ; 21 of No. A1076 ; 32 of No. A1077 ; 9 of No. A1082. Meccano Parts—4 of No. 6 ; 1 of No. 11 ; 3 of No. 12 ; 1 of No. 18b ; 1 of No. 24 ; 13 of No. 37 ; 6 of No. 37a ; 7 of No. 38 ; 1 of No. 48 ; 2 of No. 55 ; 1 of No. 64 ; 2 of No. 66 ; 1 of No. 80b ; 1 of No. 126a ; 2 of No. 133a ; 6 of No. 182. Elektron Parts—2 of No. 1570.

SPEED BOATS HORN



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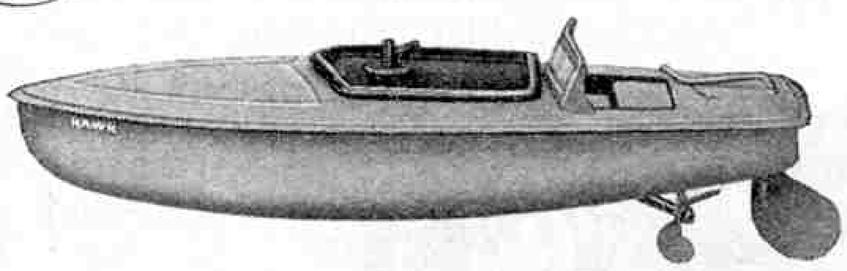
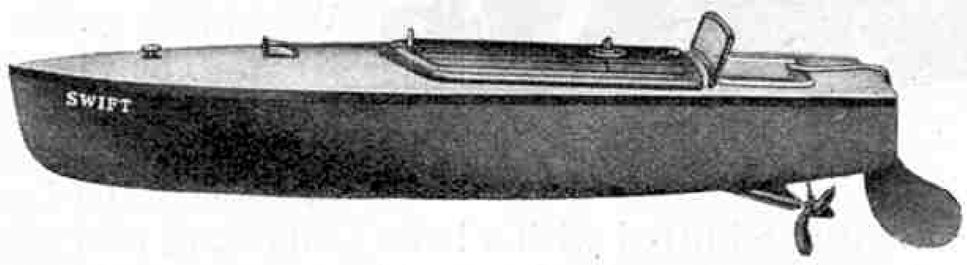


HORNBY SPEED BOAT No. 1. "HAWK." Price **2/11**
Travels over 100 ft. on one winding. Choice of three colour schemes. Dimensions: Length 9¼ in. Beam 3 in.



HORNBY SPEED BOAT No. 2. "SWIFT." Price **7/6**
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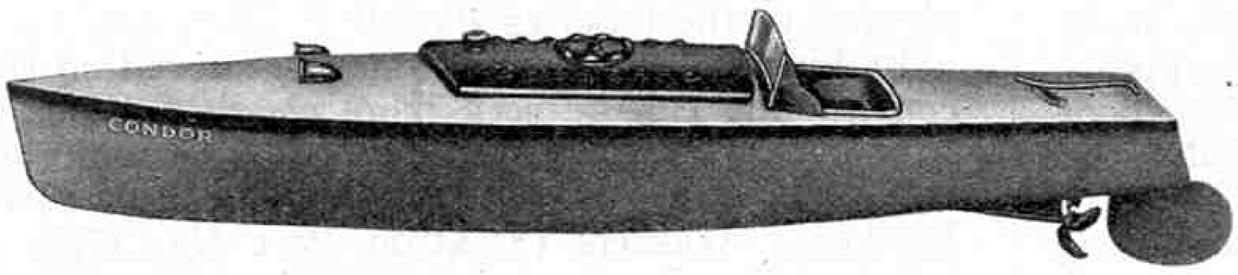
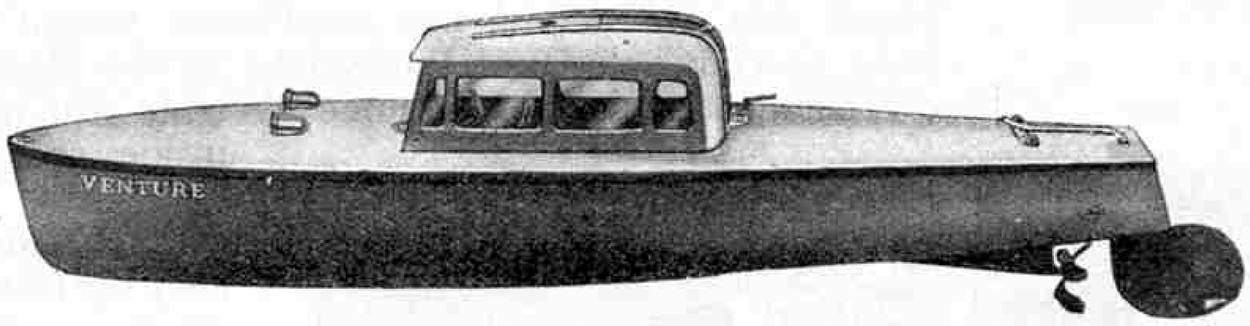
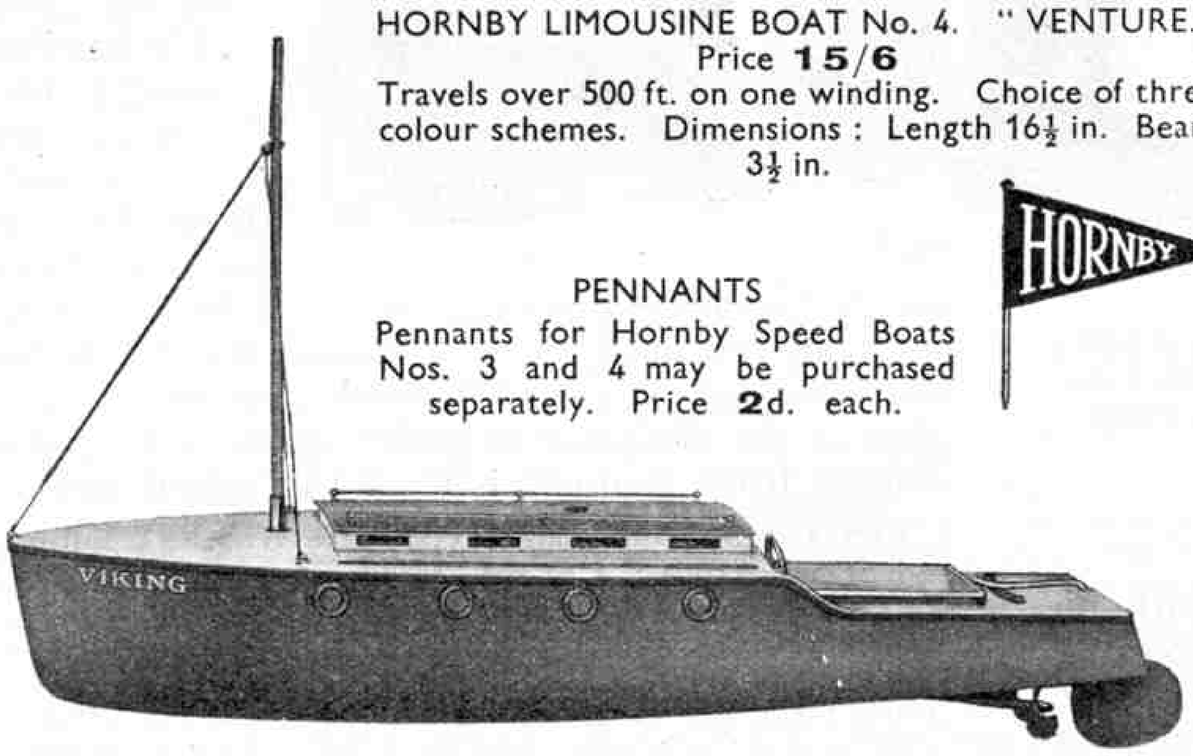


HORNBY SPEED BOAT No. 3. "CONDOR." Price **12/6**
Travels over 500 ft. on one winding. Choice of three colour schemes. Dimensions: Length 16½ in. Beam 3½ in.



HORNBY LIMOUSINE BOAT No. 4. "VENTURE." Price **15/6**
Travels over 500 ft. on one winding. Choice of three colour schemes. Dimensions: Length 16½ in. Beam 3½ in.



HORNBY CABIN CRUISER No. 5. "VIKING." Price **16/6**
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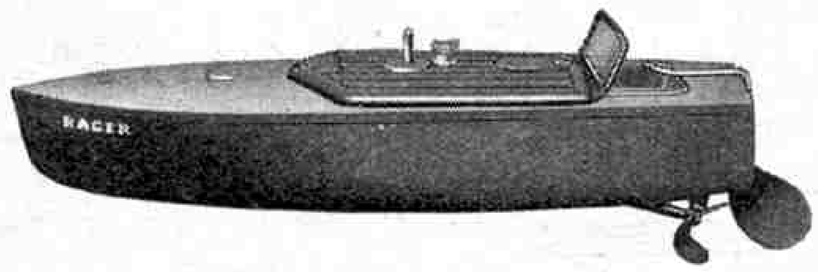
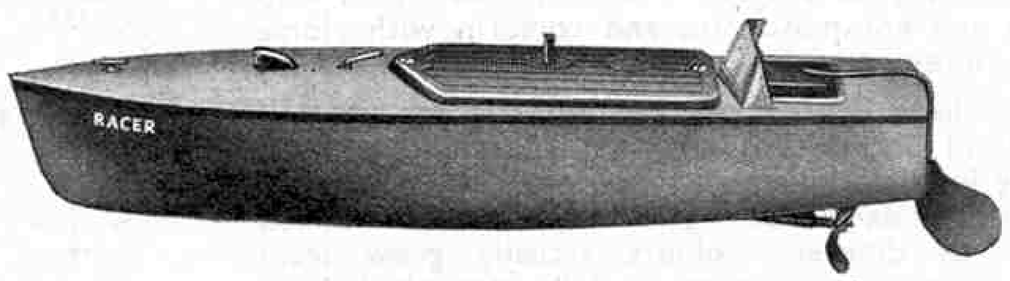
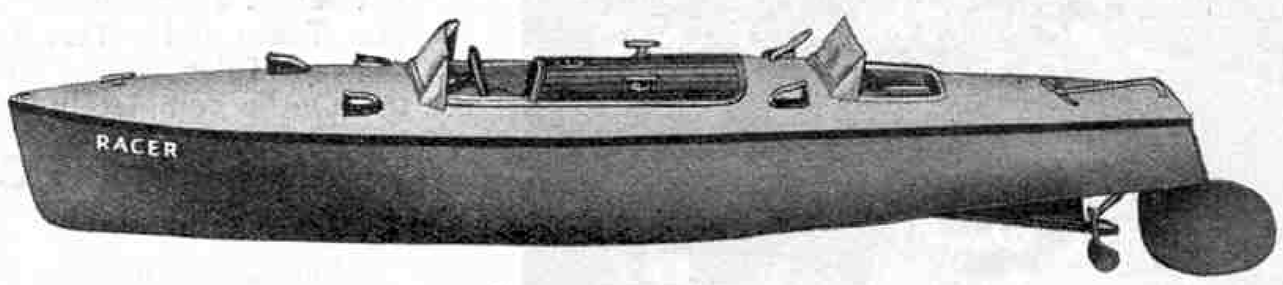


HORNBY RACING BOAT No. 1. "RACER I." Price **4/6**
Travels over 120 ft. at high speed on one winding. Finished in cream and green. Dimensions: Length 8½ in. Beam 2⅜ in.



HORNBY RACING BOAT No. 2. "RACER II." Price **8/6**
Travels over 200 ft. at high speed on one winding. Finished in Blue and Cream. Dimensions: Length 12½ in. Beam 3 in.



HORNBY RACING BOAT No. 3. "RACER III." Price **14/6**
Travels over 300 ft. at high speed on one winding. Finished in Red and Cream. Dimensions: Length 16½ in. Beam 3½ in.

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Every owner of a Hornby Speed Boat or Hornby Racing Boat should join the Hornby Speed Boat Club. This may be done by purchasing a special badge (illustrated here) from any Meccano dealer, or direct from Meccano Ltd., Binns Road, Liverpool 13. Prices: United Kingdom, **6**d., New Zealand, **10**d., South Africa, **9**d., Canada, **20** cents.

HORNBY WATER TOY

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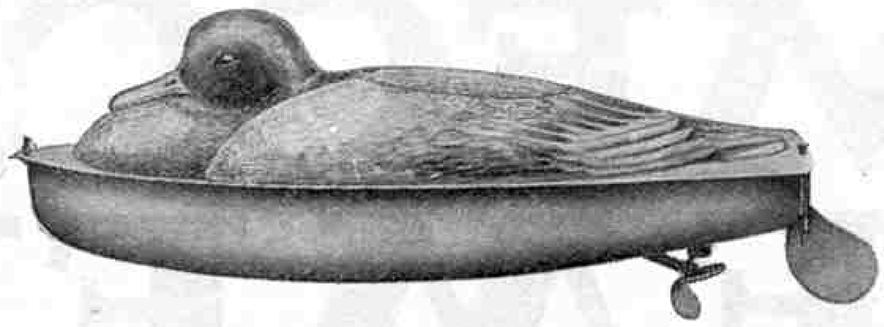

HORNBY WATER TOY (DUCK). Price **3/3**
Travels over 100 ft. on one winding. Finished in appropriate colours. Dimensions: Length 9¼ in. Beam 3 in.

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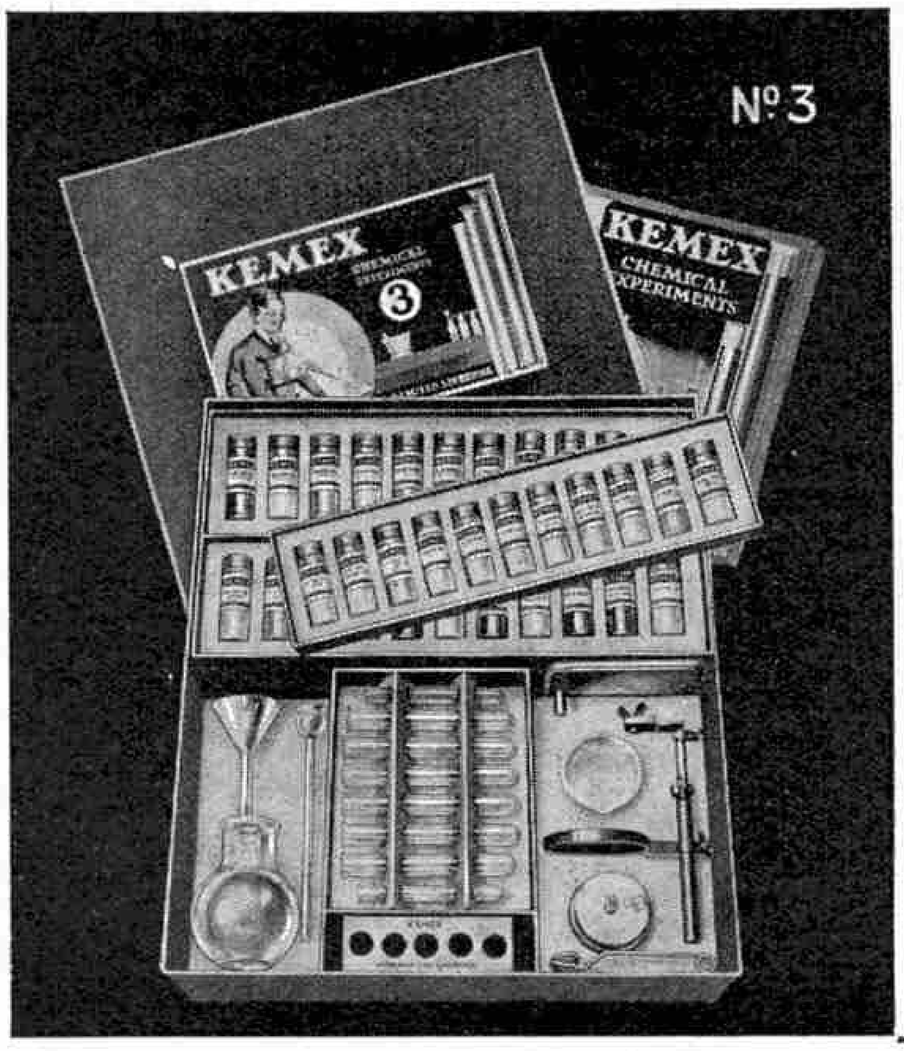

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This Outfit contains a supply of specially selected chemicals, together with a length of Magnesium Ribbon, sufficient to perform 130 attractive and varied experiments. The apparatus provided in the Outfit includes Test Tubes and a Test Tube Holder, a Funnel, Filter Papers, and Glass Delivery Tubes, with a simple and highly-efficient Spirit Lamp that makes the Outfit completely self-contained. . Price **7/6**

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This Outfit includes the whole of the contents of the No. 1 Outfit, and further chemicals that increase the range of experiments up to 250. The additional apparatus includes a porcelain Evaporating Dish, Special Test Tubes to withstand high temperatures, a handsome Test Tube Stand, and the Kemex Evaporating Stand with Wire Gauze. Price **15/-**

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MECCANO KEMEX CHEMICAL OUTFITS

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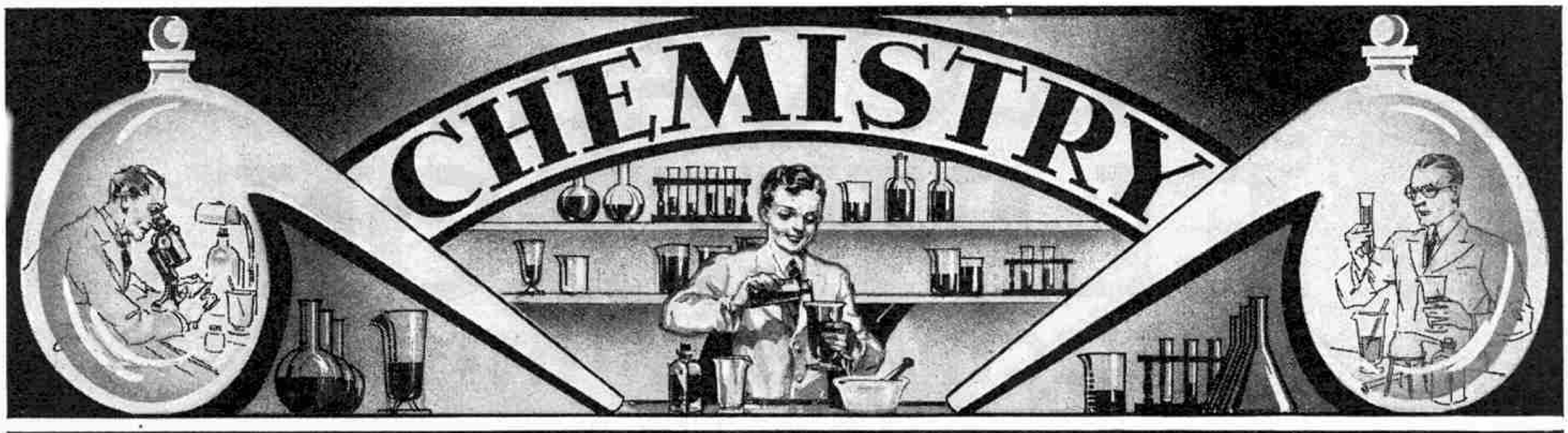
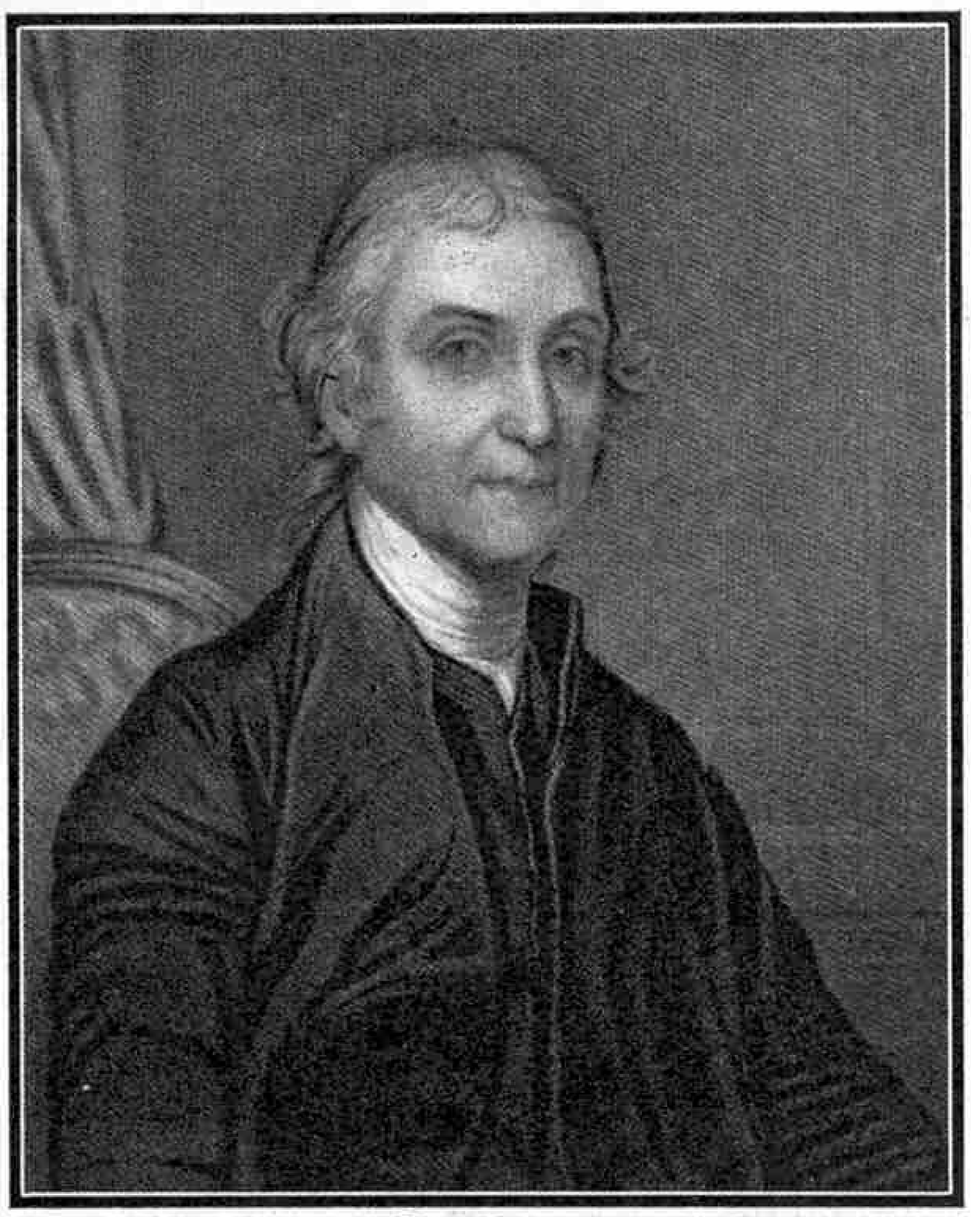


JOSEPH PRIESTLEY—A BRILLIANT PIONEER CHEMIST

JOSEPH PRIESTLEY, the famous discoverer of oxygen, was one of the most romantic figures in the story of chemistry. He was not a trained scientist, but he early became interested in electricity, and his attention seems to have been drawn to chemistry by the accident of living near a brewery, for this led him to examine the gases produced during fermentation. He can therefore be regarded as a gifted amateur who made chemistry his hobby, with the happy result that his brilliant discoveries won him fame as a pioneer of science and a remarkable experimental genius.

Priestley was born in 1733 at Fieldhead, near Birstall, in Yorkshire, and he became a Unitarian minister at the age of 22. After holding ministries in various places he became a tutor in the Academy at Warrington, where he remained for six years. In 1767 he went to Leeds as minister of Mill Hill Unitarian Chapel, and it was during his stay in Leeds that he became interested in chemistry and began the experiments with gases by which he is best remembered.

Before Priestley's time very few gases had been recognised, and little was known about them, chiefly because of difficulties due to crude methods of experimenting. For instance, a gas was then usually collected by placing a deflated balloon over the end of a tube connected with the vessel in which it was being produced. As the pressure of the gas increased the balloon became inflated, and tests were then made with the gas as it issued from this strange and unwieldy collecting vessel. Priestley changed all that by popularising the method that is familiar to Kemex experimenters, in which gases are collected by allowing them to bubble into a vessel full of liquid placed upside down with its open end under the liquid in a trough or basin. The liquid in the vessel is displaced by the incoming gas, and it is easy to apply a light to a jar of the gas collected in this manner, to lower burning substances into it, or to pour in liquids to see how they behave in contact with it.



Joseph Priestley, 1733-1804, the discoverer of oxygen.

Certain gases cannot be collected by the displacement of water because they are soluble. In these cases mercury or quicksilver can be employed and Priestley often made use of this heavy liquid metal for this purpose. His most famous experiment was carried out with a tube full of mercury inverted in a small basin containing that liquid. He had been trying the effect of heating a very large number of different chemicals by placing them in a small cylinder inverted in mercury in this manner. He could not heat the substances conveniently by means of a spirit lamp, or any other means then available, so he fell back upon the ingenious device of concentrating the Sun's rays on them by means of a burning glass. The one he used had a diameter of 12 in. and brought the Sun's rays to a focus at a point 20 in. from it.

One of the substances that Priestley heated in this ingenious manner was a red powder known to him as *mercurius calcinatus per se*, which is now called mercuric oxide. This powder can be made in various ways, one particularly interesting manner of producing it being by heating mercury strongly in the air for a considerable time, when red specks of this substance form on the surface of the metal. Priestley heated this chemical in his gas-collecting apparatus on 1st August, 1774, and found that the mercury in the tube was forced down by an invisible gas. He received a great surprise when he began to test this gas, for a candle burned in it with far greater brilliance than in the air. It was in fact the gas that we now call oxygen, and Priestley's description of his experiments was the first account of the separation of this gas in a comparatively pure state and of its recognition as a new substance.

It is curious to find that the gas had already been prepared by another chemist, who had not published an account of his experiments. This was Carl Wilhelm Scheele, a famous Swedish chemist, who had made the gas a year earlier by heating nitre, mercuric oxide and other chemicals, and gave it the names fire-air and vital air because of its powers of supporting burning and life. Other chemists previously had discovered that a gas was given off when certain substances now known to yield oxygen were heated, but Scheele was the first to separate the gas and recognise it as a new one, and Priestley, who discovered it independently, was the first to reveal the secret to the world.

Priestley discovered several other well-known gases, his ingenious methods of collecting them over liquids helping him to achieve these great results. Another discovery that we owe to Priestley is the use of carbon dioxide in making aerated waters. He did not discover this gas, which was already well known, but he was the first to realise how it could be used to make water sparkling and more palatable, and he suggested that drinking water carried on ships should be saturated with the gas in order to prevent scurvy. It is a curious fact that the gas, which does not support life and has a suffocating effect when breathed, should have such a remarkable effect in making drinking waters refreshing and palatable.

Priestley was interested in every subject of public importance as well as in his scientific pursuits, and his outspokenness and fearlessness in expressing his views led him into grave risks. At the time of the French Revolution he was a minister in Birmingham, and was accused of sympathy with the revolutionists. A public banquet held in 1791 to celebrate the fall of the Bastille led to a furious riot, and Priestley's house and chapel were sacked and burned, and he and one of his sons barely escaped with their lives, although Priestley himself had not been present at the dinner. He removed to Hackney, London, but was coldly treated by many of his old friends who disapproved of his political views, and three years later emigrated to America, where his sons had already gone. There he settled in Pennsylvania, where he lived peaceably, continuing to take an interest in his scientific work, until his death in 1804.

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In these days of radio, X-rays, and electric trams and trains, every boy should have a knowledge of electricity. The only way to gain this knowledge is by means of experiments, and the Meccano Elektron Outfits have been produced for this purpose.

These Outfits contain all the materials for carrying out a splendid series of fascinating experiments, commencing with Magnetism and passing on through Frictional Electricity to Current Electricity. In addition many interesting mechanisms can be constructed, including a Reading Lamp, an Electric Bell, a Telegraph, a Shocking Coil that gives real shocks, and Electric Motors.

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The apparatus and chemicals included in the Meccano Elektron Outfits can be obtained separately. Ask your dealer for the Elektron Folder giving a list of Elektron parts, or write for a copy to the address below.

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An Elektron Outfit will open up to you a fascinating hobby of endless variety.

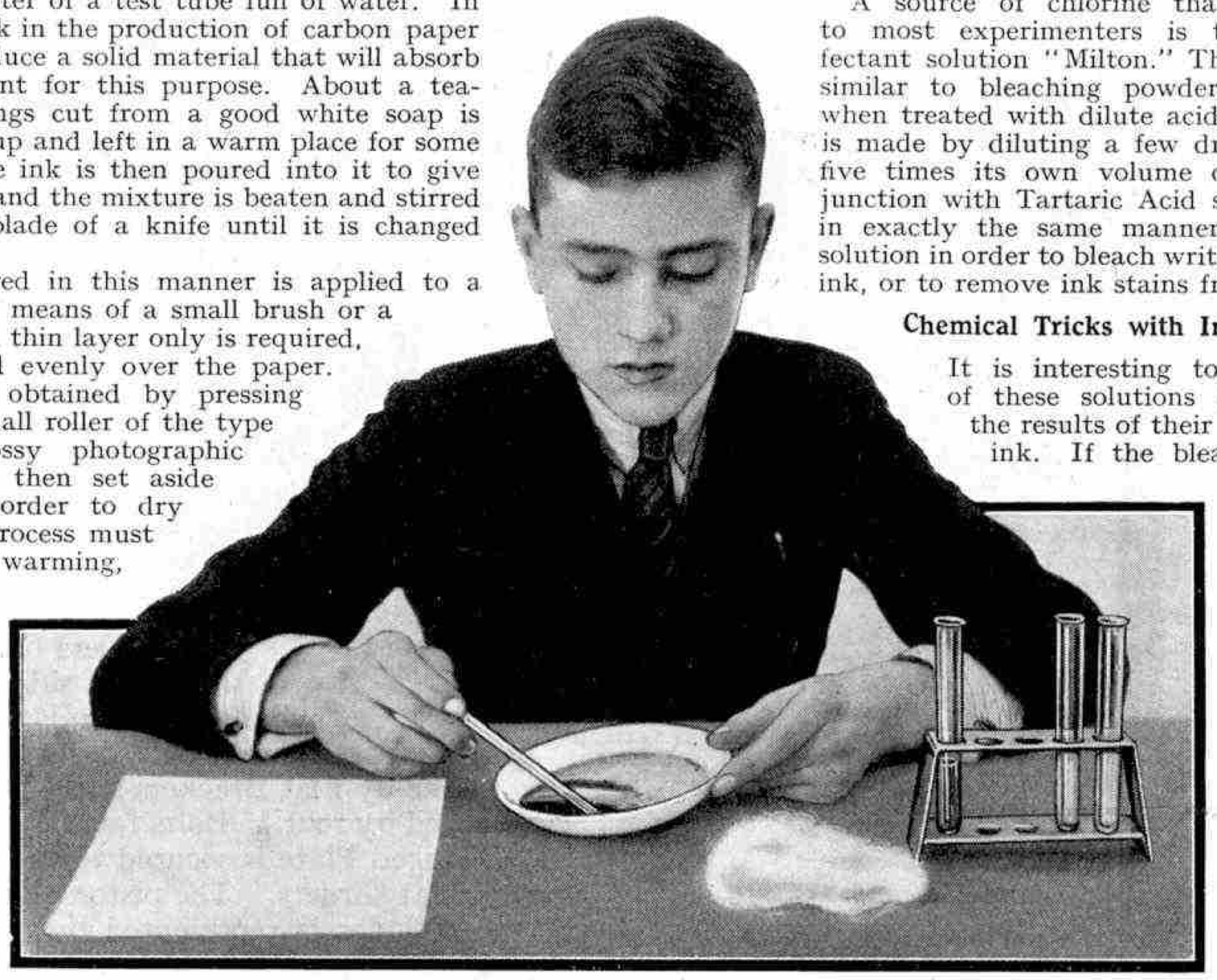
Visit your dealer to-day and ask him to show you one of these wonderful Outfits.

HOW TO MAKE COPYING PAPER

LAST month we explained how various interesting inks can be made from the contents of Kemex Outfits. One of these inks can be used in the production of carbon paper that enables excellent copies of typewriting or ordinary writing to be obtained without trouble. This is the blue ink formed by mixing solutions of one measure each of Iron Alum and Sodium Ferrocyanide in a quarter of a test tube full of water. In order to employ this ink in the production of carbon paper it is necessary to introduce a solid material that will absorb it, and soap is excellent for this purpose. About a teaspoonful of fine shavings cut from a good white soap is placed in a saucer or cup and left in a warm place for some time. Sufficient of the ink is then poured into it to give it a fairly deep colour, and the mixture is beaten and stirred with a spoon or the blade of a knife until it is changed into a thickish paste.

The material prepared in this manner is applied to a sheet of thin paper by means of a small brush or a pad of cotton wool. A thin layer only is required, and it must be spread evenly over the paper. The best results are obtained by pressing it with the aid of a small roller of the type used in making glossy photographic prints. The paper is then set aside for a day or so in order to dry thoroughly, and this process must not be hastened by warming, for if this is done the layer of inky soap is liable to crack.

The paper is used in exactly the same manner as ordinary carbon paper purchased from a stationer. It is laid on a sheet on which a copy is desired, with the coated surface downward, and writing or typing on a second sheet of paper placed above it is then reproduced on the lower sheet, the pressure causing the transference of ink from the paste to the copy.



Making carbon paper with a Kemex ink. The experimenter is making the ink into a paste with soap flakes.

Removing Blots and Ink Marks

Kemex experimenters will find it as interesting to destroy ink by chemical means as it is to make it, and no doubt will find opportunities of making use of their knowledge in removing ink blots and stains on papers and the leaves of books! What is wanted is a chemical agent that will destroy the colouring matter employed, and chlorine, the unpleasant smelling green gas, is the best agent for the purpose. This can readily be obtained from bleaching powder, which is made by passing chlorine over lime, as explained on page 41 of the No. 2-3 Kemex Manual. Two or three measures of the powder are dissolved in a quarter of a test tube full of water, and a second solution is made by dissolving two or three measures of Tartaric Acid in a similar quantity of water. A pad of cotton wool is dipped in the bleaching powder solution and the ink stain is carefully moistened with it. A similar pad is then dipped in the acid liquid and applied to the stain already wetted with the solution of bleaching powder. The alternate application of the two solutions is continued until the mark has disappeared.

The chemical action that takes place is simple. The action of the Tartaric Acid on the bleaching powder solution causes the liberation of chlorine, which is produced in contact with the ink and immediately destroys the colouring matter.

A source of chlorine that is readily available to most experimenters is the well-known disinfectant solution "Milton." This contains a chemical, similar to bleaching powder, that yields chlorine when treated with dilute acids. A suitable solution is made by diluting a few drops of the liquid with five times its own volume of water, and in conjunction with Tartaric Acid solution this is applied in exactly the same manner as bleaching powder solution in order to bleach writing made with ordinary ink, or to remove ink stains from fabric.

Chemical Tricks with Inks

It is interesting to compare the effects of these solutions on ordinary ink with the results of their application to printer's ink. If the bleaching process is tried with printer's ink it will be found that the ink remains unaffected. The explanation is that the basis of this ink is carbon, which is not bleached by chlorine. No hesitation therefore need be felt in using bleaching powder or "Milton" for removing blots that obscure print, a common occurrence in school books!

This experiment can be modified to form an interesting trick. A sheet of printed paper is dipped in ordinary ink, or is brushed over with it, and is allowed to dry. The printed characters beneath are then invisible, but by the action of a bleaching solution the ink that covers them can readily be removed. The trick can be made to take various forms, and causes great amusement if the printed words revealed convey some message to one of those who see it carried out. It may be adapted also to fortune telling, the bleaching solution then being described as the magic liquid that reveals the future. Slips of paper with "fortunes" printed on them can be obtained from various sources, but equally good substitutes can be made by writing in good Indian ink, which cannot be bleached by chlorine, and in this case the "fortunes" can be specially adapted to the characteristics of the victims of the trick.

In the *"M.M."* for December 1933 we explained how to use Sodium Ferrocyanide as a sympathetic ink, writing carried out with it being revealed by brushing the paper with a solution of Iron Alum. The effect is to form the blue ink used in making Kemex carbon paper. The secret writing becomes reddish brown on substituting Copper Sulphate for Iron Alum.

British Marine Engine History in Meccano

II.—The Paddle Wheel Era

LAST month some of the early British experiments with steam-propelled vessels were described, the last being Henry Bell's vessel, the "*Comet*," of 1812. The "*Comet*" did not meet with much public enthusiasm, and it was only with difficulty that she was made to pay for her upkeep, although, as an advertisement put it, "the elegance, safety, comfort and speed of this vessel require only to be seen to meet the approbation of the public."

The limited success of the "*Comet*" did not deter others from attempting to commercialise steam passenger boats, however, and the following 10 years saw many small vessels brought into service on the Clyde and elsewhere. Of these the "*Argyle*," subsequently the "*Thames*," appears to have been the most successful. She was a packet steamer of 70 tons, measuring 79 ft. on the keel and 16 ft. in beam, with paddle wheels 9 ft. in diameter and engines of 14 h.p. Her smoke was carried away by a funnel that acted also as a mast, being rigged with a large square sail. She had a gallery, on which the cabin windows opened, that projected to form a continuous deck except where broken by the paddle boxes, and on the outside of this gallery were painted 18 large portholes which, with two on her stern, gave her a very striking appearance. After plying for about 12 months between Glasgow and Greenock the "*Argyle*" was sold to a London firm who renamed her the "*Thames*." The voyage of this small ship from the Clyde to the Thames was a very remarkable one. Almost throughout the trip the weather was very wild, and it was only the skill and determination of Captain Dodd, an ex-Naval officer, that brought her safely through. It is interesting to note that when the "*Thames*" was off Wexford the smoke from her funnel led the local pilots to believe that she was on fire, and they put off to her assistance. Their surprise was great when they found the true state of affairs!

With reference to this vessel "*The Times*" of 8th July, 1815, said: "The *Thames*, steam yacht, from London to Margate, starts from Wool Quay, near the Custom House, Thames Street, every Tuesday and Saturday at 8 o'clock a.m. precisely, and leaves Margate on her return to London every Monday and Thursday at the same hour. . . . She has the peculiar advantage of proceeding either by sails or steam, separated or united, by which means the public have the pleasing certainty of never being detained on the water after dark, much less one or two nights, which has frequently occurred with the old packets. Against the wind, the tide, or in the most perfect calm, the passage is alike certain, and has always been achieved in one day."

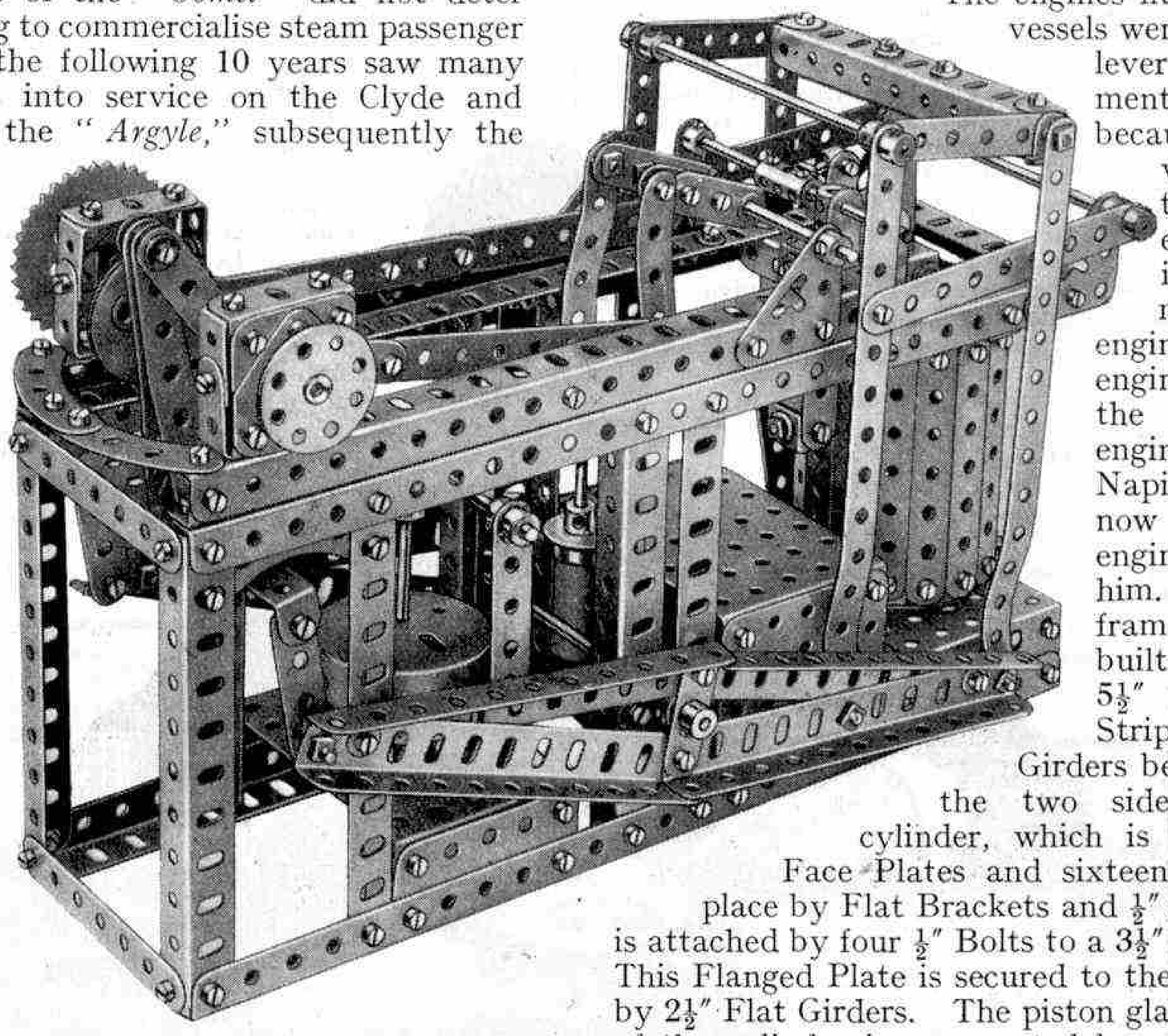


Fig. 1. A scale model of the side lever engine of the steamship "Leven," described in this article.

The engines fitted into these early vessels were usually of the side lever type, this arrangement being necessitated because of the lack of vertical space under the deck of these early vessels. Fig. 1 illustrates a scale model of a side lever engine, copied from the engine of the "*Leven*," the first vessel to be engined by Robert Napier, founder of the now famous firm of engineers named after him. Each side of the frame of the model is built up from 12½" and 5½" Angle Girders, 3½" Strips and 3½" Angle Girders being used to connect the two sides together. The cylinder, which is built up from two Face Plates and sixteen 3½" Strips held in place by Flat Brackets and ½" × ½" Angle Brackets, is attached by four ½" Bolts to a 3½" × 2½" Flanged Plate. This Flanged Plate is secured to the frame of the model by 2½" Flat Girders. The piston gland on the upper end of the cylinder is represented by a Double Bent Strip through the centre hole of which the piston rod passes.

The condenser is built up from three 3½" × 2½" Flanged Plates and two 2½" × 2½" Flat Plates, and is situated close to the cylinder as shown in the photograph. Two cylinders are bolted to the condenser, each of which is composed of a Sleeve Piece and a ¾" Flanged Wheel. These represent the bilge or waste pumps, the pump rods being operated through a series of levers and cranks from one of the Eccentrics on the crank-shaft, as shown in the illustration.

The piston rod, a 4½" Rod, is connected by a Double Arm Crank to a channel section girder built up from two 4½" Angle Girders. Each end of these two Girders carries a Double Bracket the underside lugs of which are connected together by a 4½" Strip. The method of connecting the 4½" Angle Girders to the beam is shown clearly in the illustration.

The connecting rod is built up as illustrated, and is pivotally attached at its upper end to the crank, which

consists of two Cranks locked securely together by a $\frac{1}{2}''$ Bolt. Each half of the crankshaft, a $2\frac{1}{2}''$ Rod, carries a Triple Throw Eccentric, one of which has already been described. The other is coupled by a $7\frac{1}{2}''$ Strip to a $2''$ Strip that operates the valve rod through a series of levers shown plainly in the illustration.

There remains to be fitted the air-pump. A $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate is secured to the base of the model by means of two $2\frac{1}{2}''$ Flat Girders, and to the upper face of this Plate are attached two Boiler Ends secured together by four Flat Brackets and attached to the Plate by four Bolts. The pump rod is attached to a horizontal Rod by a Coupling, this latter Rod being linked to the side levers by $2\frac{1}{2}''$ Strips.

The side lever engine held the field against all competitors for many years, and it was a very suitable engine for its type of work, the pumps and other auxiliaries being driven with little or no difficulty from the beam. Its main disadvantage lay in its great weight, and in the number of its moving parts, this latter point being of great importance when the efficiency of the engine is considered. Among the engineers who were trying to eliminate the clumsy and weighty double beam was Joseph Maudslay, who designed several different types of engines.

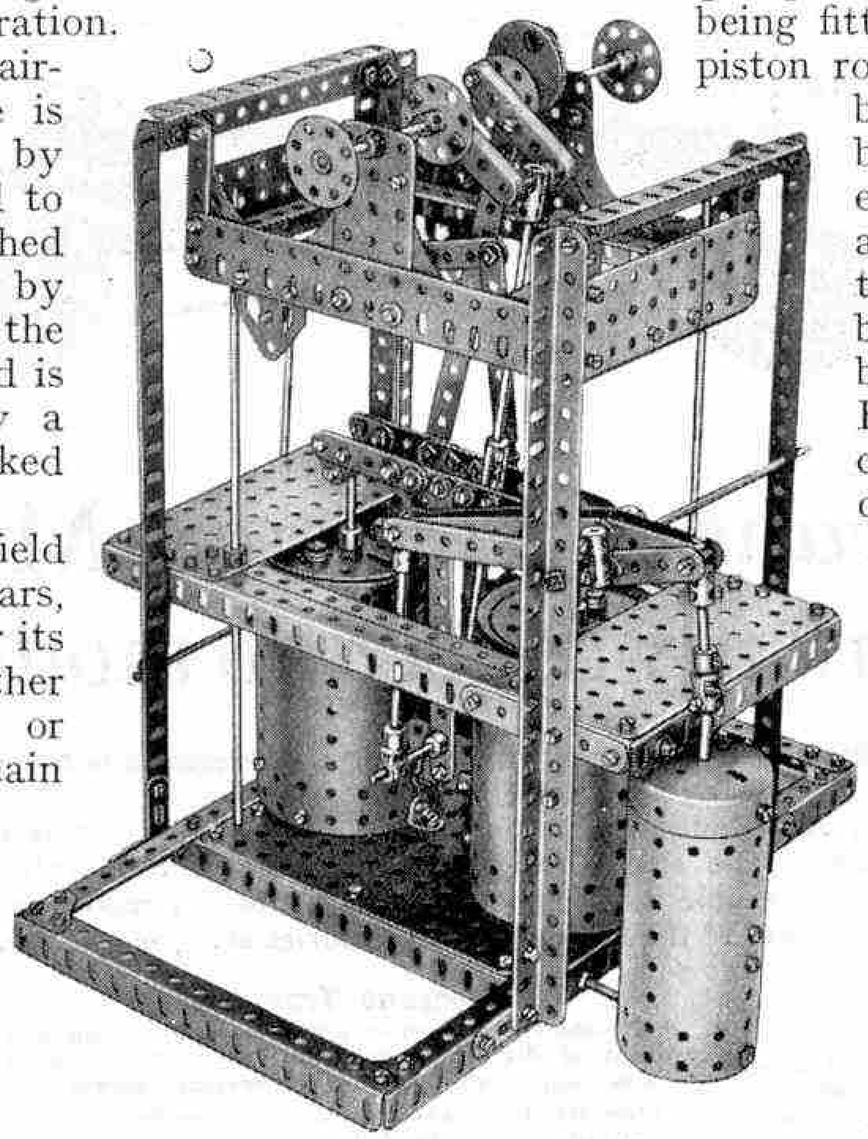


Fig. 2. A tandem paddle engine the original of which was designed by Joseph Maudslay.

One of Maudslay's early experiments resulted in the "steeple" engine which, although efficient in operation, was tall and weighty, no less than nine heavy pieces of metal being required to replace the simple connecting rod. Maudslay also invented the trunk engine which, like a petrol engine, dispenses with a piston-rod altogether, the connecting rod being attached direct to the piston. In this engine the piston was fitted at its centre with a large diameter tube that protruded from the cylinder at each end, and the connecting rod was pivoted in the centre of this. The great disadvantage of this engine lay in the greatly reduced piston area and the alternate heating and cooling of the trunk as it moved in and out of the cylinder. The necessarily large stuffing boxes also caused considerable friction and still further reduced efficiency. The trunk engine therefore never found favour with engineers for driving paddles, although it was revived later for driving screw propellers when piston speeds were increased.

One of Maudslay's most successful engines is shown in model form in Fig. 2. The base of the model consists of two $12\frac{1}{2}''$ and two $7\frac{1}{2}''$ Angle Girders joined together by Corner Brackets at each corner to form a rigid structure. In the centre of this frame is secured a platform, built up from $7\frac{1}{2}''$ Angle Girders and $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates, on which the cylinders rest. Each cylinder consists of two boilers, minus ends, opened out so that when bolted together they fit round the periphery of a $3''$ Pulley. The upper ends of these cylinders consist of $3''$ Pulleys held in place by $1'' \times \frac{1}{2}''$ Angle Brackets.

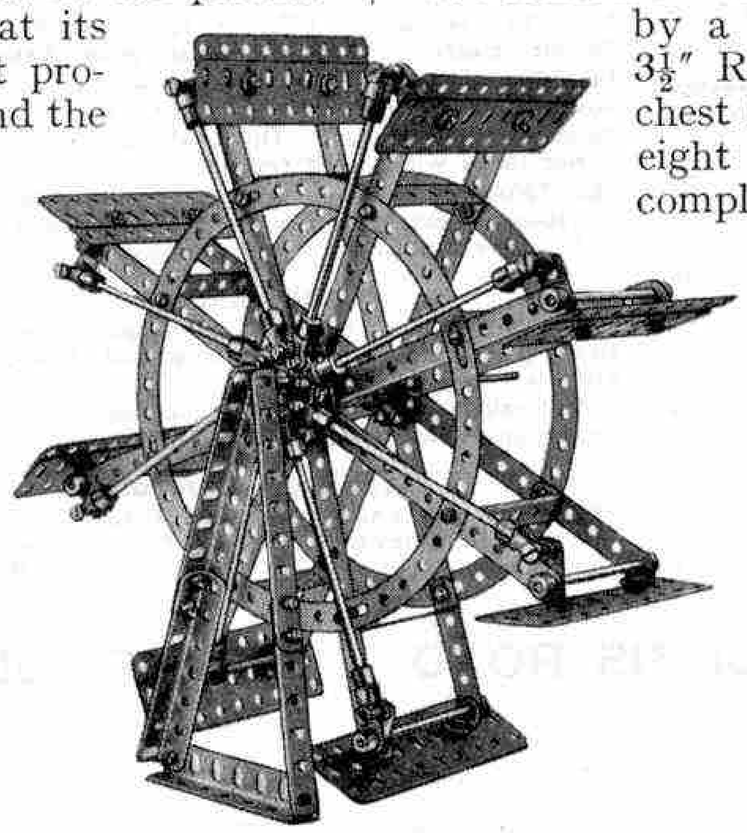


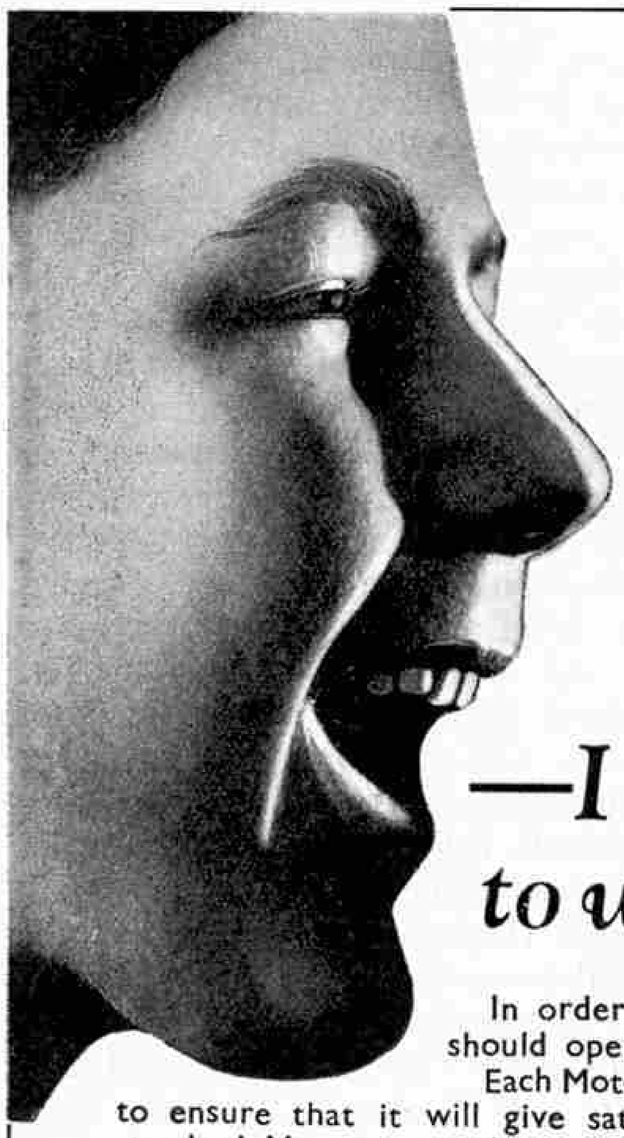
Fig. 3. A "feathering" paddle wheel suitable for fitting to any of the engines described in the article.

The cross-head slide bars, $3\frac{1}{2}''$ Strips, are bolted one to each cylinder as shown by $\frac{3}{8}''$ Bolts, Washers being used for spacing purposes between the cylinders and $3\frac{1}{2}''$ Strips. The cylinders are now attached to the base by means of $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets the piston rods also being fitted, represented by $4\frac{1}{2}''$ Rods. The piston rods are coupled together by a yoke built up as illustrated, and to this is bolted two $5\frac{1}{2}''$ Strips, at the lower ends of which the crosshead is attached. This crosshead consists of two $1\frac{1}{2}''$ Flat Girders secured together by two Double Brackets, Set Screws being used in place of ordinary Bolts for clearance purposes. The crosshead carries a short Rod that connects the piston yoke to the connecting rod, and it carries also a Small Fork Piece that couples the condenser pump to the main engine through the medium of the small beam as shown. The piston rod of the air pump is journalled, inside the cylinder, in the end hole of a $1'' \times 1''$ Angle Bracket.

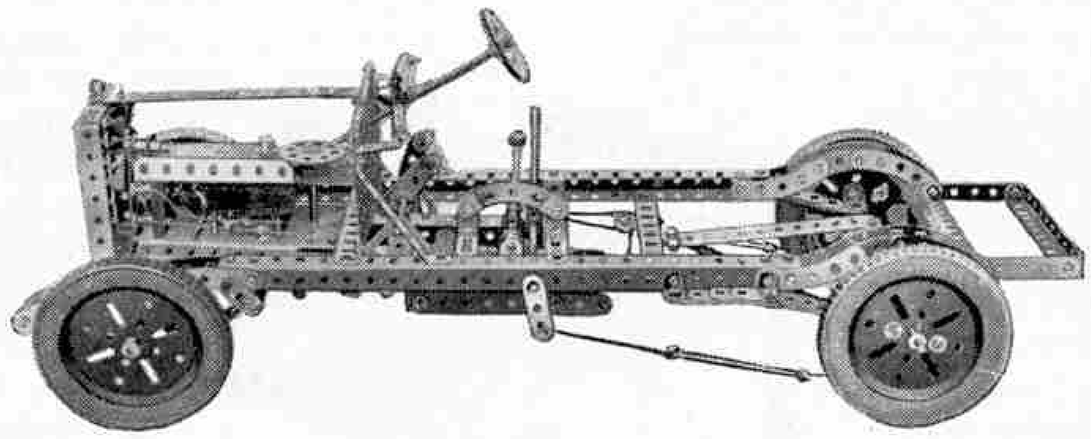
Each web of the crankshaft consists of six $2\frac{1}{2}''$ Strips bolted by $\frac{3}{8}''$ Bolts to a Bush Wheel, and the crank-pin is attached to the webs by means of Cranks. The valve derives its motion from an Eccentric on one side of the crankshaft, a $7\frac{1}{2}''$ Strip attached to this coupling it to a Double Arm Crank mounted on a horizontal Rod that is partly shown in the illustration. The opposite end of this Double Arm Crank carries a $5\frac{1}{2}''$ Strip, the upper end of which is locknutted to a $3\frac{1}{2}''$ Strip mounted on a $5''$ Rod supported in Flat Trunnions attached to the main bearings. The $3\frac{1}{2}''$ Strip is mounted two holes from one end, and the long portion is attached, by a $3\frac{1}{2}''$ Strip and an End Bearing, to a $3\frac{1}{2}''$ Rod forming the valve rod. The valve chest is built up from two Bush Wheels and eight $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, the complete fitting being held in place by means of $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets.

About the year 1827 Maudslay introduced his first oscillating cylinder engine. This met with immediate universal approval, and in a very few years almost every paddle-propelled vessel was fitted with engines of this type. Even up to quite recently oscillating engines have been fitted into certain vessels where space was very restricted.

A model of a set of early paddle engines, copied from those of the "*Leinster*," a mail boat of 1860, is shown in Fig. 4. From this illustration it will be seen how neatly engines of this type could be fitted into a vessel, minimum space and perfect balance being the outstanding features of the installation. This model is shown inside a section of the hull of an early paddle boat, but if desired the hull may be dispensed with and a framework substituted. Each of the main bearings supports is built up from a $12\frac{1}{2}''$ Angle Girder and a $12\frac{1}{2}''$ Flat Girder, their ends being bolted to each side of the hull section or framework.



This fine Meccano Model of a Motor Chassis is driven by a 6 volt Meccano Electric Motor.



—*I want a Meccano Motor to work my Meccano models*"

In order to obtain the fullest enjoyment from the Meccano hobby you should operate your models with a Meccano Motor.

Each Motor is strongly made and the utmost care is taken in its manufacture to ensure that it will give satisfaction. The side plates and bases are pierced with the standard Meccano equidistant holes, which enable the motor to be built into any model in the exact position required. Particulars and prices of the Motors and Accessories are given below.

Meccano Clockwork Motors

These are the finest clockwork Motors obtainable for model driving. They have exceptional power and length of run and their gears are cut with such precision as to make them perfectly smooth and steady in operation.

X SERIES CLOCKWORK MOTOR. A fine Motor specially designed to drive with ease any of the X Series models. It is non-reversing ... ... Price 2/6

No. 1 CLOCKWORK MOTOR. An efficient and long-running Motor fitted with a brake lever. It is non-reversing ... ... Price 5/–

No. 1a CLOCKWORK MOTOR. The Motor is more powerful than the No. 1 Motor and is fitted with reversing motion. It has start, stop and reverse levers. Price 7/6

No. 2 CLOCKWORK MOTOR. This is a Motor of super quality. Brake and reverse levers enable the Motor to be started, stopped or reversed, as required. Price 10/–

Meccano Electric Motors

The five Meccano Electric Motors listed below provide smooth-running power units for the operation of Meccano models. The 6-volt Motors may be operated either from a 6-volt Accumulator or through a Transformer direct from the mains, providing that the supply is alternating current. They cannot be run satisfactorily from dry cells. The 20-volt Motors are most conveniently operated through a 20-volt Transformer from alternating current supply mains.

No. E1 Electric Motor (6-volt). Non-reversing	Price 9/–
No. E6 Electric Motor (6-volt). Reversing	,, 15/6
No. E1/20 Electric Motor (20-volt). Non-reversing	,, 10/–
No. E20A Electric Motor (20-volt). Non-reversing	,, 16/6
No. E20B Electric Motor (20-volt). Reversing	,, 18/6

Meccano Transformers

A Meccano Transformer provides a convenient and safe means of driving a Meccano Electric Motor from the mains supply where this is alternating current.

There are six Transformers in the series, all of which are available for the following A.C. supplies :—100/110 volts, 50 cycles ; 200/225 volts, 50 cycles ; 225/250 volts, 50 cycles. Any of the Transformers can be specially wound for supplies other than these at a small extra charge. When ordering a Transformer the voltage and frequency of the supply must always be stated.

No. T6 Transformer (Output 25 VA at 9 volts) for 6-volt Electric Motors. Fitted with speed regulator. Price 21/–

No. T6M Transformer (Output 25 VA at 9 volts) for 6-volt Electric Motors. This is similar to No. T6, but is not fitted with a speed regulator ... ... Price 16/6

No. T6A Transformer (Output 40 VA at 9/3½ volts) or 6-volt Electric Motors. Fitted with speed regulator and separate circuit for supplying current for eighteen 3½-volt lamps ... ... Price 26/6

No. T20 Transformer (Output 20 VA at 20 volts) for 20-volt Electric Motors. Fitted with 5-stud speed regulator ... ... Price 21/–

No. T20M Transformer (Output 20 VA at 20 volts) for 20-volt Electric Motors. This is similar to No. T20, but is not fitted with speed regulator ... ... Price 16/6

No. T20A Transformer (Output 35 VA at 20/3½ volts) for 20-volt Electric Motors. Fitted with speed regulator and output sockets for lighting lamps ... Price 26/6

Accumulators

The 6-volt 20-amp. Accumulator is specially suitable for running Meccano 6-volt Motors and Hornby 6-volt Electric Trains ... ... Price 27/9

The 2-volt 20-amp. Meccano Accumulator is supplied for converting 4-volt Accumulators to 6-volt ... Price 9/3

Resistance Controller

This Controller enables the speed of Meccano 6-volt Motors and Hornby 6-volt Electric Trains to be regulated as desired ... ... Price 3/9

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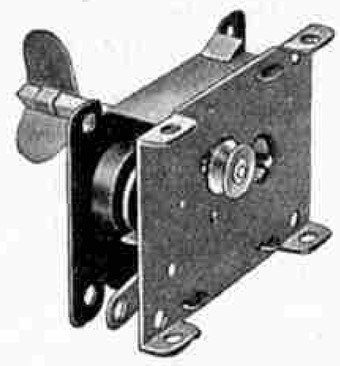
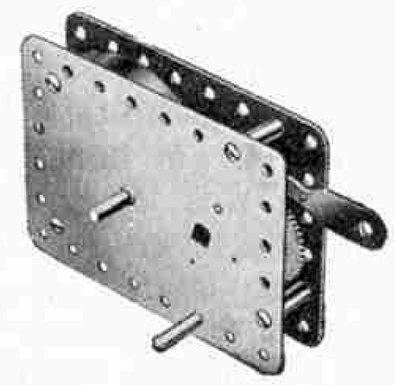
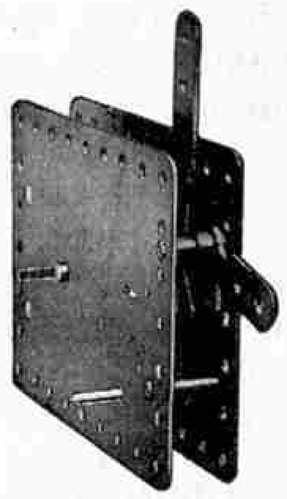


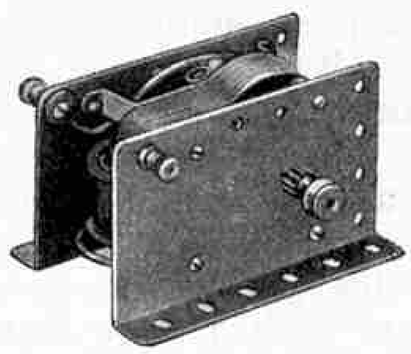
X Clockwork Motor



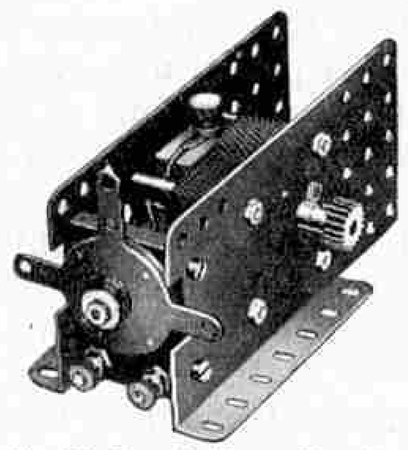
No. 1 Clockwork Motor



No. 2 Clockwork Motor

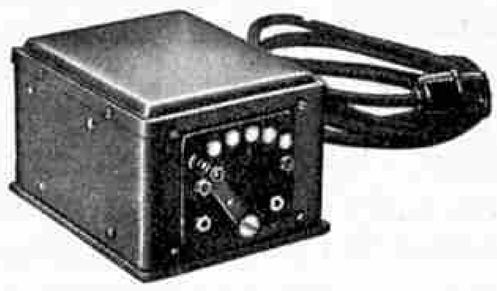


No. E1/20 Electric Motor (20 volt)



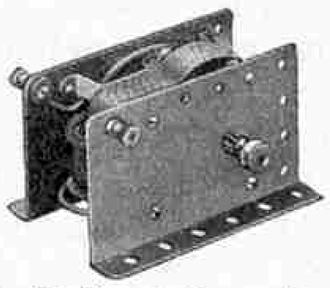
No. E6 Electric Motor (6-volt)

6-volt 20-amp. Accumulator

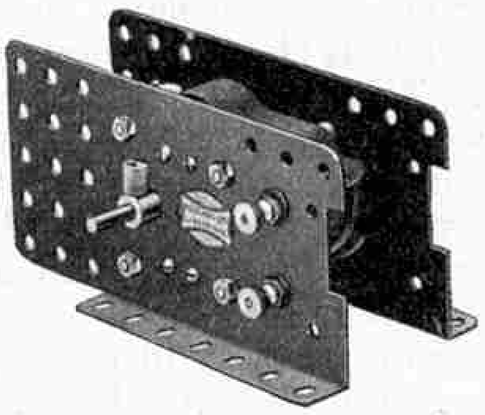


No. T20 Transformer

Resistance Controller



No. E1 Electric Motor (6-volt)



No. E20a Electric Motor (20-volt)

When these two main supports are in place they are connected across by the four main bearings shown in the photograph, each of which consists of two $1\frac{1}{2}''$ Angle Girders and three $3\frac{1}{2}''$ Strips. The $1\frac{1}{2}''$ Angle Girders protrude below the main supports and these ends are fitted with $2\frac{1}{2}''$ Small Radius Curved Strips and $1''$ Corner Brackets as shown.

Each of the two cranks consists of two separate webs, one of which is built up from six $1\frac{1}{2}''$ Strips and two Cranks, and the other from six Flat Trunnions and two Cranks. The crank-pin is represented by a $1\frac{1}{2}''$ Rod and the big-end by three Couplings held together by two $1''$ Threaded Rods. The crankshaft also carries two single throw Eccentrics and a third crank, this latter being composed of two Couplings and a $1''$ Rod. The two connecting rods on this crank are built up from $1\frac{1}{2}''$ Strips and End Bearings, the End Bearings being attached to $2''$ Rods. These Rods form the pistons of the two condenser pumps, both of which are mounted on $\frac{3}{8}''$ Bolts. The Bolts for each pump are supported in the end holes of two $1'' \times 1''$ Angle Brackets that are attached to one of the two main cylinder supports by two $1''$ Triangular Plates.

The two oscillating cylinders are each built up from two Face Plates joined together by means of eight $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. The spaces between the Double Angle Strips are filled in by $3\frac{1}{2}''$ Strips held in place by Flat Brackets. It should be noted that one of the Double Angle Strips and its attendant Strip is made detachable by clamping the securing nuts in place by $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets. Two valve chests are fitted to each cylinder, these being built up from Channel Bearings and $1'' \times \frac{1}{2}''$ Angle Brackets. They are fitted in place as shown in the photograph and the two valve rods are connected together by two Flat Brackets and one $2\frac{1}{2}''$ Strip, bent slightly as desired. The $2\frac{1}{2}''$ Strip is locknutted at its centre to a second $2\frac{1}{2}''$ Strip bolted at its upper end to one of the single throw Eccentrics that have already been referred to in this article.

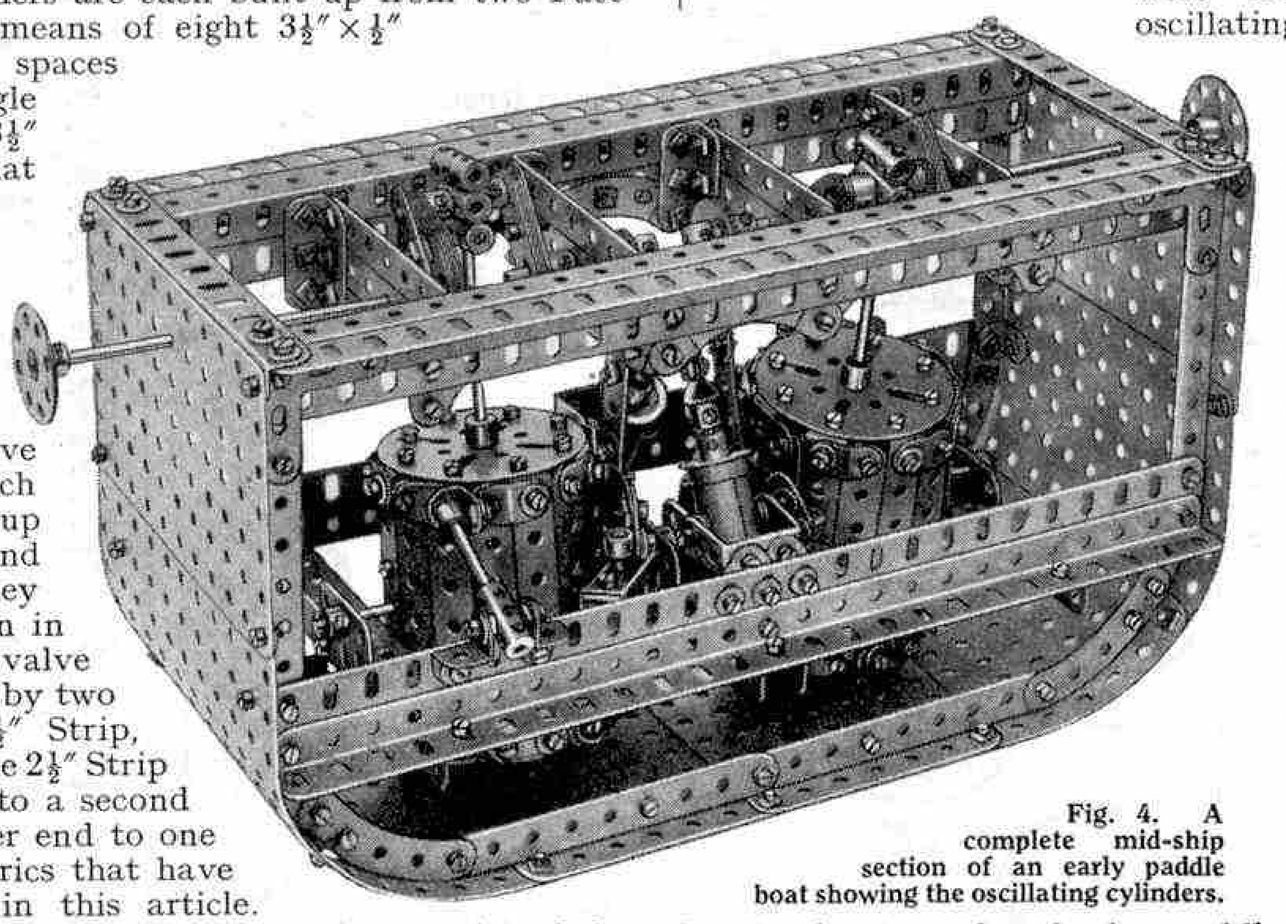


Fig. 4. A complete mid-ship section of an early paddle boat showing the oscillating cylinders.

The cylinder pivots, which in the actual engine consist of the steam inlet and exhaust pipes, are represented in the model by a Crank Shaft locked rigidly to the cylinders by Double Arm Cranks. These Crank Shafts allow the piston rods free movement in the cylinders. The ends of each cylinder pivot are mounted in the centre hole of a $1\frac{1}{2}''$ Flat Girder attached by a $5\frac{1}{2}''$ Angle Girder to a main cross member of the hull section.

To complete the model two subsidiary pumps are fitted. Each of these is built up from a Coupling mounted on the shanks of two Bolts that are supported in Corner Angle Brackets, one right-hand and one left. The pump rod, a $2''$ Rod, is fixed by a Collar to a Flat Bracket bolted to the cylinder top.

Paddle Wheels of the "feathering" type

The paddle wheel shown in Fig. 3, is provided for the benefit of those wishing to fit paddles to any of the models described in this article. It is of the "feathering" type, and will greatly enhance the appearance of any model to which it is fitted. The two hub centres are represented by Bush Wheels mounted on a suitable Rod and spaced apart for a distance of $2\frac{1}{2}''$ by means of Couplings and Collars. Each Bush Wheel carries eight spokes formed from $5\frac{1}{2}''$ Strips, which are braced by a $7\frac{1}{2}''$ Circular Strip, bolted in place as shown in the illustration. The two halves of the paddle wheel are coupled together by means of eight $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips.

Each paddle float consists of two $4\frac{1}{2}''$ Flat Girders joined together to form a double width flat girder, and the complete float is attached to the wheel by $1'' \times \frac{1}{2}''$ and $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets. The $1'' \times \frac{1}{2}''$ Angle Bracket is fitted with a Pivot Bolt on which a Small Fork Piece is free to swing. This Fork Piece is connected by a $4\frac{1}{2}''$ Rod and End Bearing to a Bush Wheel that, in the model, is supported on a framework of Angle Girders. In actual practice this part of the paddle wheel is carried on the outer edge of the paddle box, its work being to "feather" the floats. This means that the floats are made to enter and leave the water in a vertical position, thus increasing the efficiency of the paddle. It should be noted that one of the rods connecting the floats to the "feathering" mechanism is bolted rigidly to the Bush Wheel, but all the others are free to pivot.

No history of marine engineering would be complete without mentioning the "*Great Eastern*," which at the time of her launch in 1858 was nearly twice as long as the largest ship in the world, and considered to be absolutely impregnable to attacks from either wind or sea. She was double-hulled, and it was estimated that the space between her two hulls would hold 2,500 tons of water ballast if necessary. She was 680 ft. long, 82 ft. 6 in. wide and 58 ft. deep. Transverse bulkheads divided her into a series of 60-ft. compartments.

"Great Eastern" too far in advance of the times

This remarkable ship was equipped with paddles and a screw propeller, and sails were fitted on her six masts. Her designer, the famous engineer Isambard K. Brunel, hoped that she would attain a service speed of 15 knots, but she never came up to expectations. Commercially she was a failure, but this was due almost entirely to the fact that she was too far in advance of the times, and thus never really had a fair chance.

The paddles of the "*Great Eastern*" weighed 836 tons and were driven by two double-cylinder oscillating engines having a total indicated horse power of 3,411. The cylinders were 6 ft. 2 in. in diameter, with a stroke of 14 ft., and each weighed 28 tons. The engines could be worked independently if required. Apart from the number of cylinders these engines were almost identical with the oscillating engines already described. For screw propulsion the "*Great Eastern*" was equipped with a huge four-bladed cast iron screw 24 ft. in diameter, and of 44 ft. pitch. The shaft of the propeller was 150 ft. long. The screw was driven by horizontal direct acting engines with a total indicated horse power of 4,886. When driven by both screw and paddles the ship attained a speed of $14\frac{1}{2}$ knots, by the screw alone her speed was about nine knots, and under her paddle wheels alone about seven knots.

The launching of the "*Great Eastern*" was fixed for 3rd November, 1857, but on that occasion the great ship moved only a few feet and then stuck fast, and it was not until 31st January, 1858, that she actually took the water. Her bad luck began with her first trial in September, 1859, for an explosion occurred that resulted in the death of six men and injuries to several others. Her first voyage was from Southampton to New York, and was accomplished in 11 days. The return trip was made in 9 days 11 hours. In 1861 she carried over 2,000 troops to Quebec and returned to Liverpool with about 500 passengers.

The only work on which the "*Great Eastern*" could be really successfully employed was that of cable laying, for which her great size was very valuable in enabling large quantities of cable to be carried on board. In 1868 she was employed on laying the Atlantic cables and she continued on this work at intervals until 1886. No other suitable work at sea could be found for her, and in that year she was bought by a firm of drapery and tea merchants and subjected to the indignity of being used as a kind of show place for advertising purposes. Four years later she was sold to be broken up, and thus ended her career.

Development of high steam pressures

It should be remembered that steam pressure also has played a tremendous part in the fight for efficiency in marine engines, and although it is not intended to discuss boilers and steam generating plant generally in these articles, a short comparison will doubtless help the reader to realise the tremendous change that has overtaken marine engines in this direction. The very early engines worked at a boiler pressure of between two and 7 lb. per sq. in., and anything over this was considered undesirable, one firm going so far as to ask Parliament to prohibit the use of steam generated at pressures of more than 10 lb. per sq. in.! These ideas have passed with the greatly improved metals now obtainable, however, and to-day it is quite commonplace for marine engines to have a working pressure of 250 lb. per sq. inch, and over. Recent experiments have shown that such a pressure is far from being the practicable limit, and although difficulties still present themselves in regard to material, it is certain that before long far higher pressures will be adopted.

MECCANO
PARTS & ACCESSORIES

REAL ENGINEERING PARTS IN MINIATURE

Meccano parts, many of which are here illustrated, combine to form a complete miniature engineering system with which practically any movement known in mechanics may be correctly reproduced.

New parts are always being introduced in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual engineering practice.

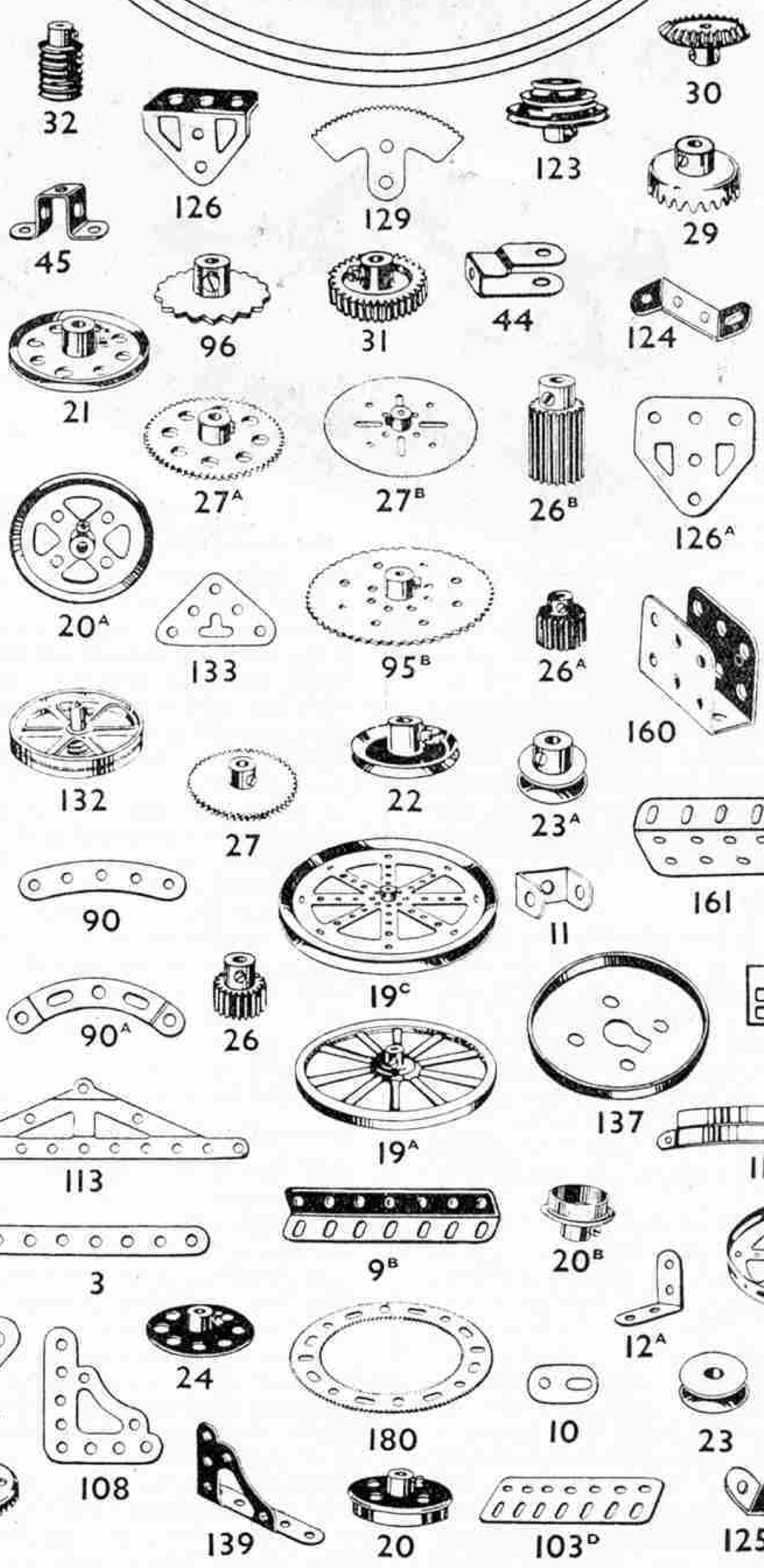
MECCANO LTD., Binns Road
LIVERPOOL 13

PRICES OF PARTS ILLUSTRATED

No.			s.	d.
3.	Perforated Strips, 3½"	½ doz.	0	4
9b.	Angle Girders, 3½"	,,	0	8
10.	Flat Brackets	,,	0	2
11.	Double Brackets	each	0	1
12a.	Angle Brackets, 1" x 1"	½ doz.	0	4
19a.	Wheels, 3" diam., with set screws	each	0	6
20.	Flanged Wheels, 1⅛" diam.	,,	0	5
20b.	,, ,, ¾" ,,	,,	0	4
	Pulley Wheels			
19c.	6" dia. with centre boss and set screw	each	2	0
20a.	2" ,, ,, ,,	,,	0	5
21.	1½" ,, ,, ,,	,,	0	4
22.	1" ,, ,, ,,	,,	0	3
23a.	½" dia. with centre boss and grub screw	,,	0	3
22a.	1" dia. without centre boss and grub screw	,,	0	2
23.	½" ,, ,, ,,	,,	0	2
24.	Bush Wheels	,,	0	4
26.	Pinion Wheels, ½" dia., ¼" face	,,	0	4
26a.	,, ,, ½" ,, ½" ,,	,,	0	6
26b.	,, ,, ½" ,, ¾" ,,	,,	0	8
	Gear Wheels			
27.	50 teeth to gear with ¾" pinion	each	0	6
27a.	57 ,, ,, ,, ½" ,,	,,	0	6
28.	Contrate Wheels, 1½" diam.	,,	0	9
29.	,, ,, ¾" ,,	,,	0	6
30.	Bevel Gears, ⅞", 26 teeth	,,	0	9
30a.	,, ,, ½", 16 ,,	,,	0	6
30c.	,, ,, 1½", 48 ,,	,,	1	6
	(30a and 30c can only be used together)			
31.	Gear Wheels, 1", 38 teeth	each	1	0
32.	Worms	,,	0	5
44.	Cranked Bent Strips	,,	0	1
45.	Double ,, ,,	,,	0	1
46.	,, Angle Strips, 2½" x 1"	½ doz.	0	6
55.	Perforated Strips, slotted, 5½" long	each	0	2
61.	Windmill Sails	4 for	0	6
77.	Triangular Plates, 1"	each	0	1

PRICES OF PARTS ILLUSTRATED (Cont.)

No.			s.	d.
90.	2½" Curved Strips, 2⅜" radius	each	0	1
90a.	2½" Curved Strips, cranked, 1⅜" radius, 4 to circle	,,	0	1
95b.	Sprocket Wheels, 56 teeth, 3" diam.	,,	0	6
96.	Sprocket Wheels, 18 teeth, 1" diam.	,,	0	3
99.	Braced Girders, 12½" long	½ doz.	2	6
102.	Single Bent Strips	each	0	1
103d.	Flat Girders, 3½" long	½ doz.	0	7
108.	Architraves	each	0	2
110.	Rack Strips, 3½"	,,	0	2
113.	Girder Frames	,,	0	3
118.	Hub Discs, 5½"	,,	1	3
119.	Channel Segments (8 to circle, 11½" diam.)	,,	0	4
123.	Cone Pulley	,,	1	3
124.	Reversed Angle Brackets, 1"	½ doz.	0	4
125.	,, ,, ,, ½"	,,	0	3
126.	Trunnions	each	0	2
126a.	Flat Trunnions	,,	0	1
129.	Rack Segments, 3" diam.	,,	0	5
132.	Flywheels, 2¾" diam.	,,	2	0
133.	Corner Brackets, 1½"	,,	0	1
133a.	,, ,, 1"	,,	0	1
137.	Wheel Flanges	,,	0	3
139.	Flanged Brackets (right)	,,	0	2
143.	Circular Girders, 5½" diam.	,,	1	0
145.	Circular Strips, 7½" diam. over all	,,	0	9
147.	Pawls, with Pivot Bolt and nuts	,,	0	3
148.	Ratchet Wheels	,,	0	6
154a.	Corner Angle Brackets, ½", right hand	½ doz.	0	6
154b.	Corner Angle Brackets, ½", left hand	,,	0	6
160.	Channel Bearings, 1½" x 1" x ½"	each	0	2
161.	Girder Brackets, 2" x 1" x ½"	2 for	0	3
167	Geared Roller Bearings	each	20	0
168.	Ball Bearings, 4" diam.	,,	3	0
170.	Eccentrics, ½" throw	,,	0	9
180.	Toothed Gear Ring, 3½" diam. 133 external teeth / 95 internal ,,	,,	2	0

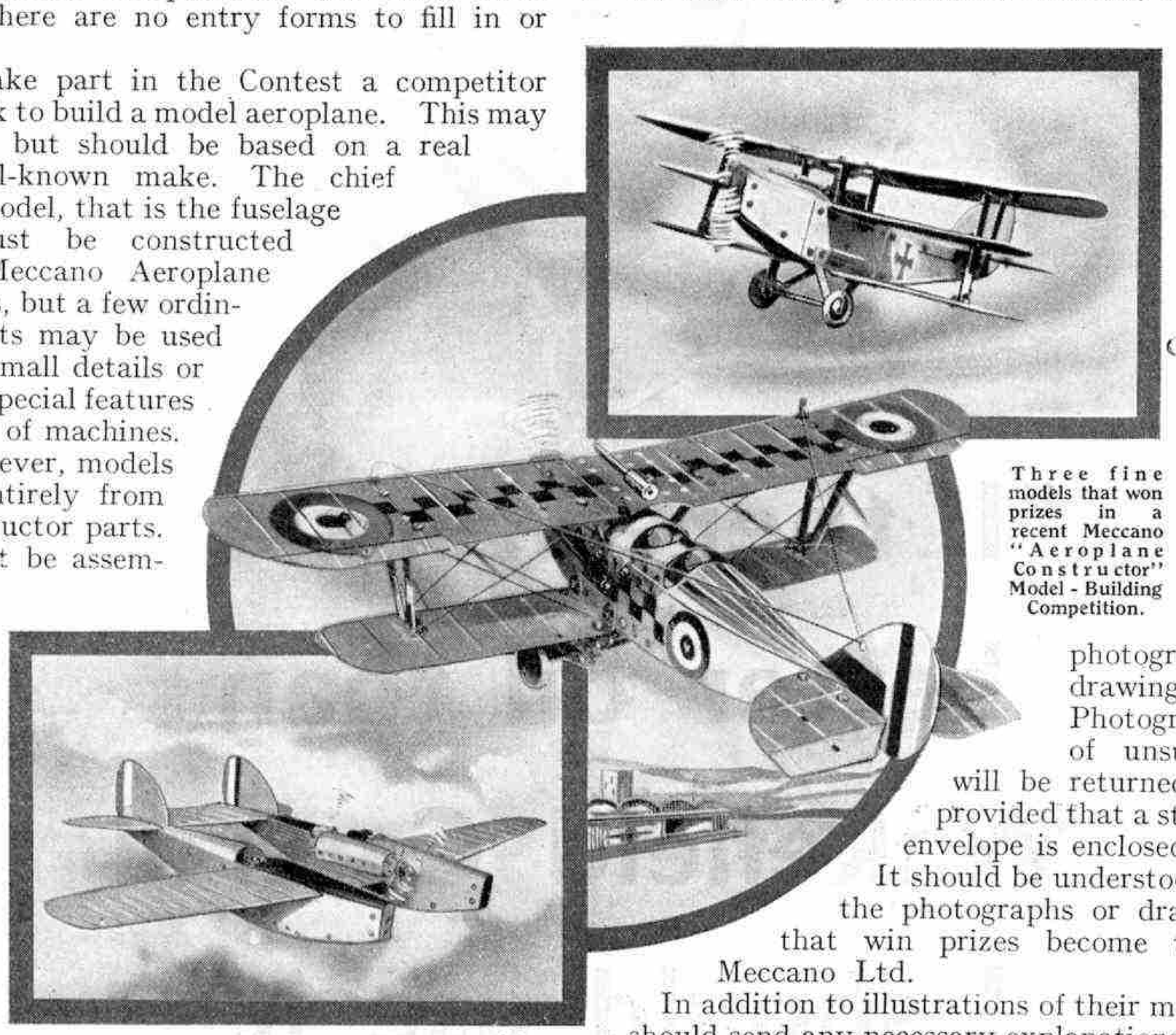


Model-Building Competition

For Models Built from Aeroplane Constructor Parts

This month we are arranging a competition for the benefit of owners of Meccano Aeroplane Constructor Outfits. The present contest is similar to the previous Aeroplane Constructor competitions that have been organised, and there are no entry forms to fill in or fees to pay.

In order to take part in the Contest a competitor should set to work to build a model aeroplane. This may be of any type, but should be based on a real machine of well-known make. The chief portions of the model, that is the fuselage and wings, must be constructed entirely from Meccano Aeroplane Constructor parts, but a few ordinary Meccano parts may be used for reproducing small details or for representing special features of certain makes of machines. If preferred, however, models may be built entirely from Aeroplane Constructor parts. Each model must be assembled by the competitor without assistance from anyone. Competitors may submit two or more models if they wish, but no competitor will be awarded more than one prize, and when more than one model is sent they will be grouped together and judged on their joint merits.



Three fine models that won prizes in a recent Meccano "Aeroplane Constructor" Model-Building Competition.

Competitors must not copy the models illustrated in the Aeroplane Constructor Instruction Manuals or other Meccano publications. They should first of all select a suitable prototype, and then set to work to reproduce it as closely as possible. Hundreds of illustrations of real aeroplanes that will make fine subjects for this Contest have appeared from time to time in the *"M.M."* Many of these can be reproduced very accurately with Aeroplane Constructor parts, and the more closely a model resembles the actual aeroplane on which it is based, the greater will be its chance of winning a prize.

As we wish every competitor to have a fair chance, irrespective of his age, the Contest is divided into three Sections: (A) for competitors over 14 years of age living in the British Isles; (B) for competitors under 14 living in the British Isles. Section C for competitors of all ages living Overseas. The age of each competitor will be taken into consideration when judging the models.

A separate and similar set of prizes will be awarded for the most neatly assembled, realistic, and sturdily built models received in each Section. Details of the prizes appear at the foot of this page.

Competitors must not send the actual model. The best plan is to send a photograph, but any competitor who does not possess a camera, and is unable to obtain a professional photograph, may send a drawing of his model. Photographs or drawings of unsuccessful models will be returned to the senders provided that a stamped addressed envelope is enclosed with the entry. It should be understood, however, that the photographs or drawings of entries that win prizes become the property of Meccano Ltd.

In addition to illustrations of their models competitors should send any necessary explanations concerning their construction, but these should be as brief as possible.

Competitors must write their name, age, and full address in block letters on the back of each drawing or photograph submitted. An entry from which this important information is missing will automatically be disqualified.

Entries should be sent in a sealed envelope and should be addressed to "April Aeroplane Constructor Model-Building Contest," Meccano Ltd., Binns Road, Liverpool 13.

Sections A and B will close on 30th June 1934, but in order to give competitors in distant parts of the world plenty of time to prepare and send in their entries, Section C will remain open until 31st August, 1934. Any entries received after that date, however, will not be considered. Intending competitors are advised to start work on their models immediately and to send in their entries well in advance of the closing date.

"Aeroplane Constructor" Contest

The Prizes

A separate and similar set of prizes as listed below will be awarded in each of the Sections A, B and C.

First Prize: Meccano or Hornby Goods value £3-3s.
Second Prize: Meccano or Hornby Goods value £2-2s.
Third Prize: Meccano or Hornby Goods value £1-1s.
Five Prizes of Meccano or Hornby Goods value 7/6.

Certificates will also be awarded in each Section.

Prizewinners will be allowed to select any goods they like from current Meccano and Hornby catalogues.

"The Autocar" Drawing.

"If there were a better oil than Wakefield Castrol I should use it"

Malcolm Campbell

28th March, 1934

HOLDER of the WORLD'S LAND SPEED RECORD OF 272 m.p.h.

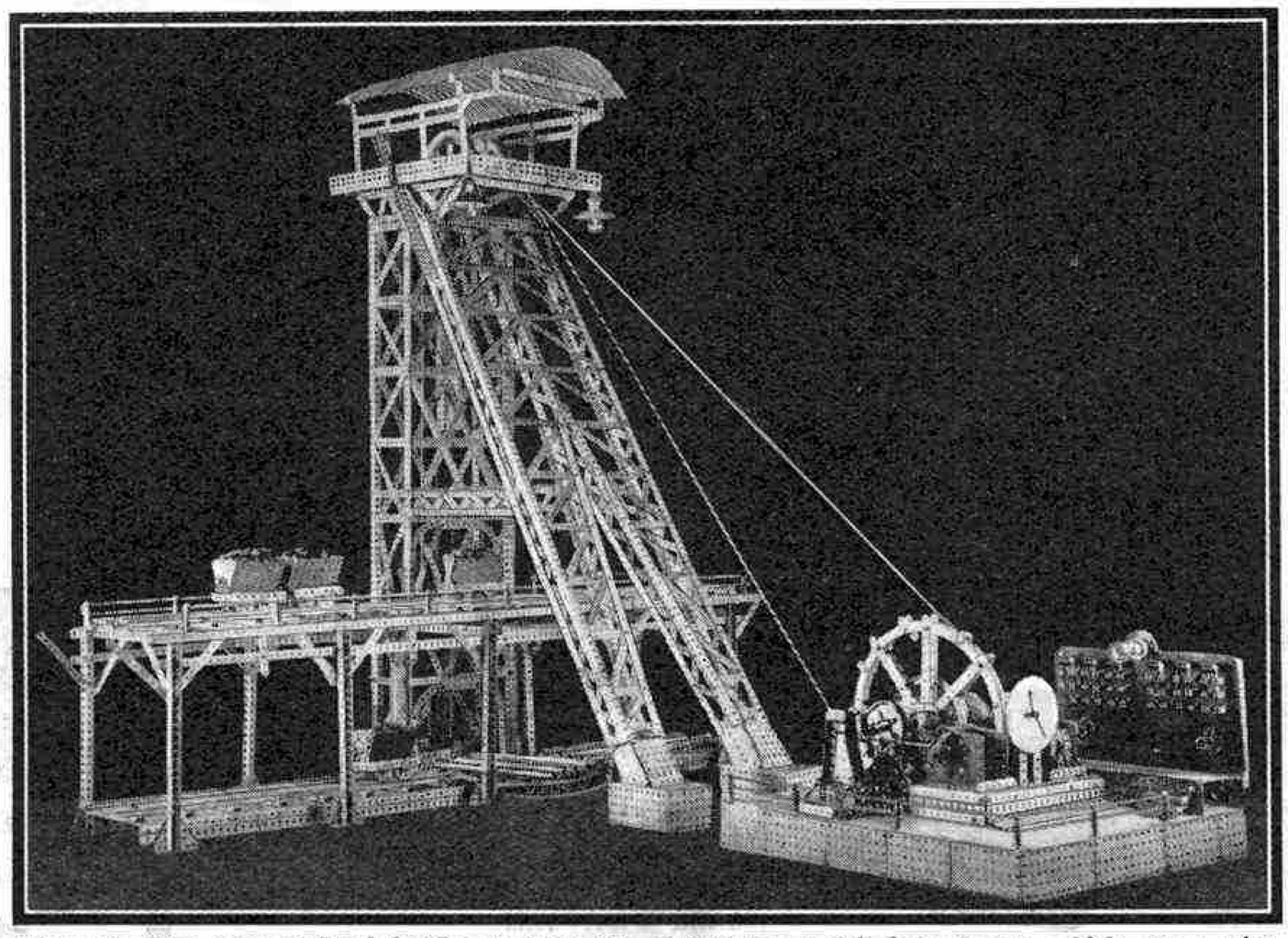
Model-Building Contest Results

By Frank Hornby

"September" Competition

The Meccano competitions announced each month in the "*M.M.*" continue to attract a great amount of attention, and it is obvious from the large number of entries received that model-builders welcome these opportunities to increase their stock of Meccano or Hornby goods by winning prizes with their models. In each competition I find entries from all parts of the world, and it is a pleasure to examine them, although it is usually a difficult task to pick out the best efforts! The "September" Contest, full details of which were announced in the "*M.M.*" for September 1933, was no exception to the rule, and in each of the two Sections into which the entries were divided are to be found models that reflect great credit on the builders.

In this Contest, Home and Overseas competitors had an opportunity of pitting their skill against each other. The entries from all competitors over 12 years of age were grouped in Section A, and those from competitors under 12 in Section B, and the Overseas boys have done remarkably well in carrying off some of the principal prizes in both Sections, as will be seen from the prize list below. In Section A the Second and Third Prizes, and in Section B the Third Prize went overseas. This is a good record, and I shall watch with interest to see if this success is maintained in the "Aeroplane Constructor" Contest that is announced in this issue. The full list of awards in the "September" Competition is as follows:



Many excellent constructional details are to be seen in this fine model pit-head gear, which won a prize for J. Willems, Antwerp.

Section A (Home and Overseas competitors over 12)

FIRST PRIZE, Meccano or Hornby goods value £3-3s.: A. Armstrong, Leicester. SECOND PRIZE, value £2-2s.: R. Barrie, Providence. THIRD PRIZE (tie), Two competitors share goods value £1-1s.: P. Palmer, Epsom, Auckland, N.Z.; J. Willems, Antwerp, Belgium.

TEN PRIZES of goods value 5/–: F. Byron, Liverpool; A. Macleod, Clevedon; E. Roberts, East Grinstead; N. Scullard, Hove; W. Bladergroen, Amsterdam, Holland; W. Jones, Winnipeg, Canada; F. Marquand, Woodville, New Zealand; K. Orams, Blenheim, N.Z.; J. Pienaar, Johannesburg, S. Africa; G. Schulz, Coromby, Australia.

"*Standard Mechanisms*" MANUALS: C. Brown, Edinburgh; C. Clarke, Bristol; P. Curtis, Whitstable; D. Holloway, Squirrels Heath; R. Lawford, Bexleyheath; G. Mathieson, Angus; A. Stephenson, Liverpool; S. Wotherspoon, Liverpool; R. Latimer, Rangoon, India; A. Ness, Pt. Dalhousie, Canada; D. Ritchie, Kyogle, Australia.

Section B (Home and Overseas competitors under 12)

FIRST PRIZE, Meccano or Hornby goods value £2-2s.: R. Morison, Cambridge. SECOND PRIZE, goods value £1-1s.: W. Todd, Belfast. THIRD PRIZE, goods value 10/6: A. Rossi, Mognano, Italy.

TEN PRIZES of goods value 5/–: A. Gasston, Brighton; F. Gay, Edgware; P. Hands, Gerrards Cross; C. Latham, Westbury-on-Trym, Bristol; N. Macleod, Leigh-on-Sea; J. Shaw, Oldham; W. Soutar, Aberdeen; M. Orde, Chateau d'Oex, Switzerland; A. de Ras, The Hague, Holland; B. Williamson, Oamaru, New Zealand.

A drum cylinder letterpress printing machine is the principal model in Section A. The sheet of paper to be printed is placed on a feed board against lays, which lift at the correct moment to allow the cylinder grippers to take the paper. The grippers are worked by a "tumbler" movement, and in the interval between the lays lifting and the paper grippers closing, the sheet is held in position by drop-fingers. Passing into the machine the paper is brought into contact with the type, printed, and then delivered face up by means of tapes and flyer sticks. The press is fitted with fast and loose pulleys for Motor drive, and for "inching" purposes a slow motion worked by a differential gear drives the machine at half speed. An inking system consisting of an ink slab, two distributor rollers, two forme inking rollers, and one rider roller, is fitted to the model.

The main difficulty in constructing a model of this kind lies in arranging the correct sequence of the various movements. In Armstrong's model great care has been taken to copy the mechanism of the actual machine as closely as possible, and the builder has gone to considerable trouble to ensure its functioning correctly.

A neatly built model of a tank locomotive was sent by Mr. R. Barrie, and won Second Prize in Section A. It is driven by a Meccano Electric Motor concealed in the body, and is designed to run on a three rail electric track, the current being picked up from the centre rail by means of a Meccano Collecting Shoe (Part No. 149) fitted to the underside of the locomotive. The model is fitted with brakes and reverse motion controlled from the cab.

Third Prize in Section A was shared by J. Willems, Antwerp, and P. R. Palmer, Auckland, N.Z. Willems sent the fine model pit-head gear illustrated on this page, and Palmer's model is a grandfather clock, which is fitted with Westminster chimes, stands over 6 feet in height, and runs for 22 hours with one complete winding of the 19 ft. weight by which it is operated.

The models in Section B are of a more ordinary type, but they are well built and cleverly thought out. R. Morison built a model omnibus designed to carry 22 passengers, and its chief claims to the big prize that it won are neatness and sound mechanical construction. W. Todd won his prize with two models of modern motor cars, one of which represents an Alfa-Romeo and the other an M.G. Magnette.

A model of an Italian railway station won Third Prize for A. Rossi. It is constructed entirely from Meccano, and is complete with booking offices, waiting rooms and trains. This model is certainly the most original among the principal prize winners in this Section, and if it had been more neatly built it would have won a bigger prize.

Third "Aeroplane" Constructor Contest

The results in the Home Section of this Competition, which was announced in the October, 1933, issue of the "*M.M.*" are as follows:

Section A

FIRST PRIZE, Meccano or Hornby goods value £2-2s.: D. Canning, Cumberland. SECOND PRIZE, goods value £1-1s.: H. Brockett, London, E.6. THIRD PRIZE, goods value 10/6: D. Jeffrey, Kirkintilloch.

TWELVE PRIZES of Meccano or Hornby goods value 5/–: G. Bonelle, West Bromwich; L. Campbell, Fareham; D. Couzens, Whitchurch; K. Durham, Christchurch, Hants.; W. Hudson, Weymouth; J. Jenkinson, Rochdale; H. L. Noverray, Glasgow, W.3; C. Rowcroft, Maidstone; J. Somerville, Lundin Links; H. Taylor, Birmingham; J. Tottle, Taunton; R. Williams, London, N.10.

PRIZES of "*Meccano Engineer's Pocket Books*": J. Burton, Evesham; F. Dorling, Nunthorpe, Yorks.; J. Gabbutt, Melior; J. Heath-Brown, Farnham; D. Holloway, Squirrels Heath; A. Parminter, Dawlish; A. Henton, East Croydon; L. Slater, Portsmouth; D. Symes, Dawlish; T. Woodhouse, Littleover, Derby.

HORNBY SERIES

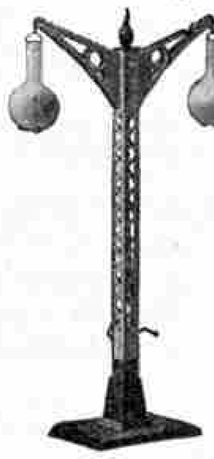
HORNBY ACCESSORIES

GAUGE 0

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway. A selection of Hornby Accessories is shown on this page and also on page 324. Ask your dealer to show you the full range.

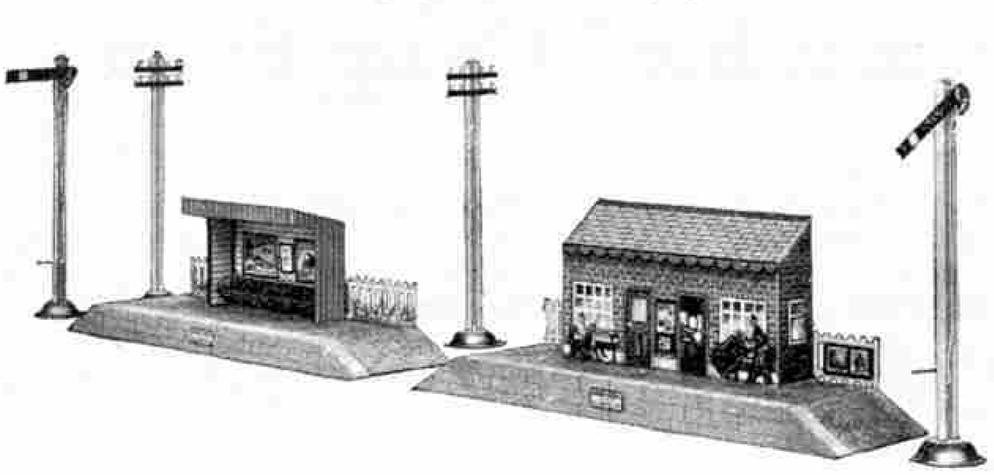
LAMP STANDARD No. 1E ELECTRICAL (Single, as illustrated). Price **3/6**

LAMP STANDARD No. 2E ELECTRICAL (Double). Price **4/3**



LAMP STANDARD No. 1 (Single). Price **3/6**

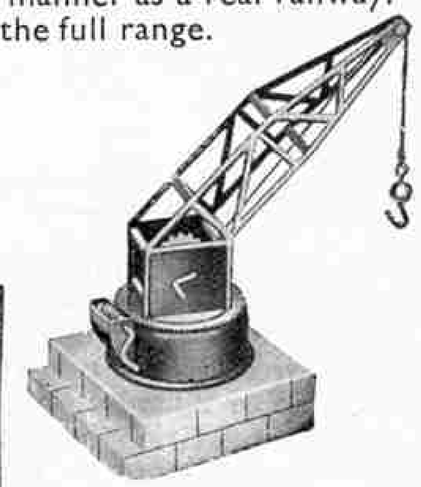
LAMP STANDARD No. 2 (Double, as illustrated). Price **4/6**



M STATION SET (7 pieces). Price **3/-** complete

The components of the M Station Set may be purchased separately.

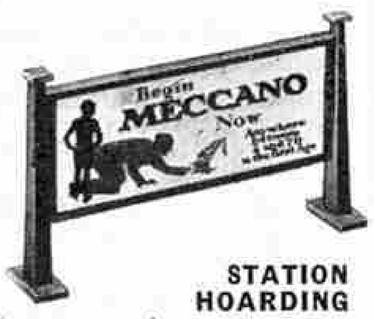
M Signal Box. Price **4**d. M Signal. Price **4**d. M Station. Price **1/-**. M Telegraph Pole No. 1. Price **3**d. M Wayside Station. Price **10**d.



PLATFORM CRANE
Fitted with a crank handle and ratchet mechanism.
Price **4/9**

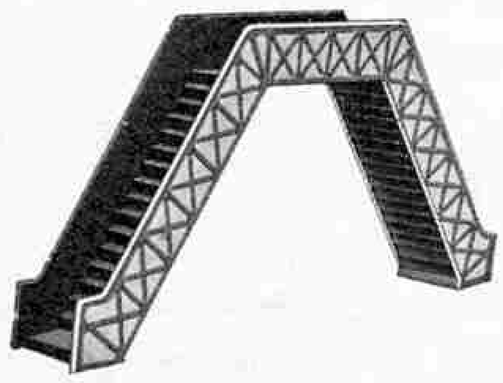
LUBRICATING OIL
Specially prepared for Hornby Trains, Rolling Stock and Accessories.
Price, per bottle **6**d.

GRAPHITE GREASE
An ideal lubricant for the springs of Hornby Locomotives and Hornby Speed Boats, Meccano and Aero Clockwork Motors, and Meccano Motor Cars.
Price, per tube, **6**d.



STATION HOARDING
This is a realistic accessory, suitable for the station platform. Brightly coloured.
Price **8**d.

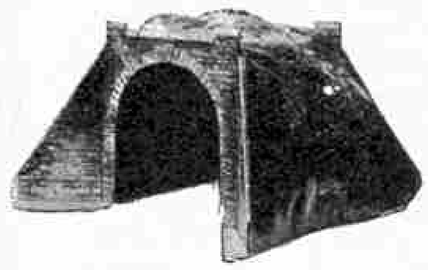
RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier Shovel and Poker. Price **1/6**



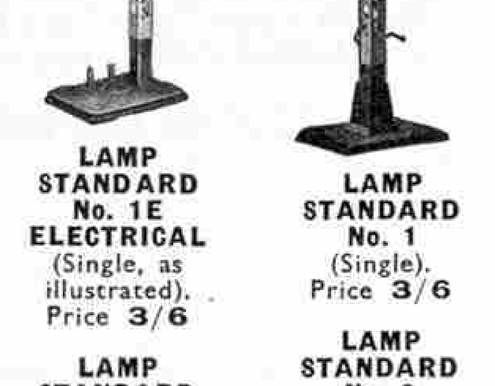
M SERIES FOOTBRIDGE
This strongly-built Footbridge is made to span a single track. Price **1/3**

LOADING GAUGE (Illustrated). Price **2/3**

M LOADING GAUGE Price **1/-**



TUNNEL (Metal) (As illustrated). Price **5/9**



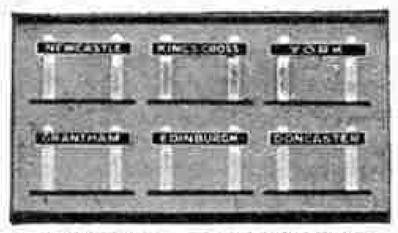
RAILWAY ACCESSORIES No. 5
Gradient Posts and Mile Posts.
Price **2/-**

MANSELL WHEELS
These wheels are die-cast and are correctly designed. They may be fitted to Hornby Vans, Coaches, etc.
Price, per pair, **4**d.

ISLAND PLATFORM
Length 32¼ in., heigth 6¾ in., width 3 in. Price **7/6**
The ramps may be purchased separately. Price per pair **2/6**

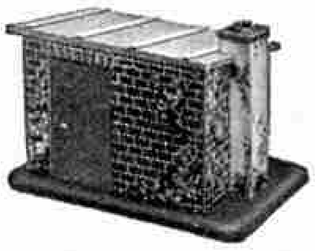
SHUNTER'S POLE
Price **3**d

RAILWAY ACCESSORIES No. 8
Notice Boards ... Price **2/3**

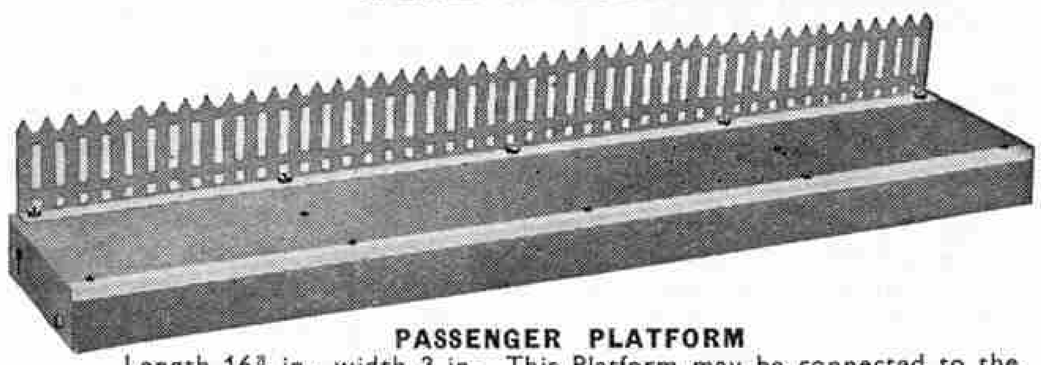


RAILWAY ACCESSORIES No. 9
Station Name Boards.
Price **2/6**

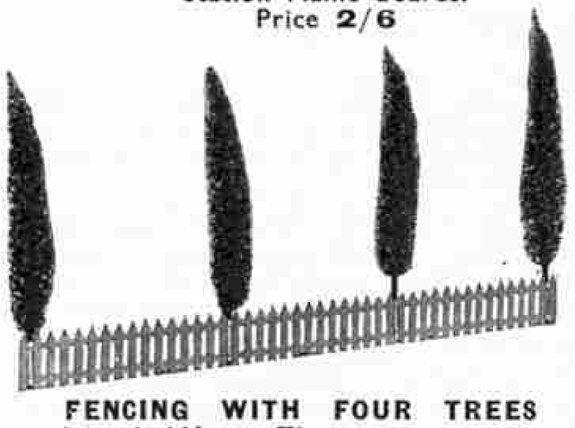
EACH HORNBY ACCESSORY ILLUSTRATED ON THIS PAGE IS TASTEFULLY FINISHED IN ATTRACTIVE COLOURS.



PLATELAYER'S HUT
Price **1/-**

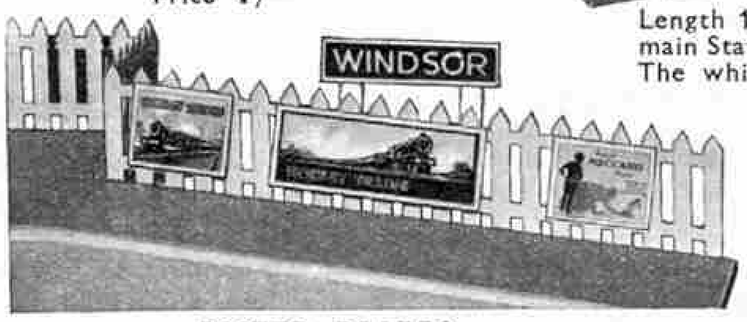


PASSENGER PLATFORM
Length 16¾ in., width 3 in. This Platform may be connected to the main Station or used separately ... ... Price **3/6**
The white Paled Fencing may be purchased separately. Price per length **6**d.



FENCING WITH FOUR TREES
Length 16½ in. The miniature trees are detachable. Price per pair **2/6**

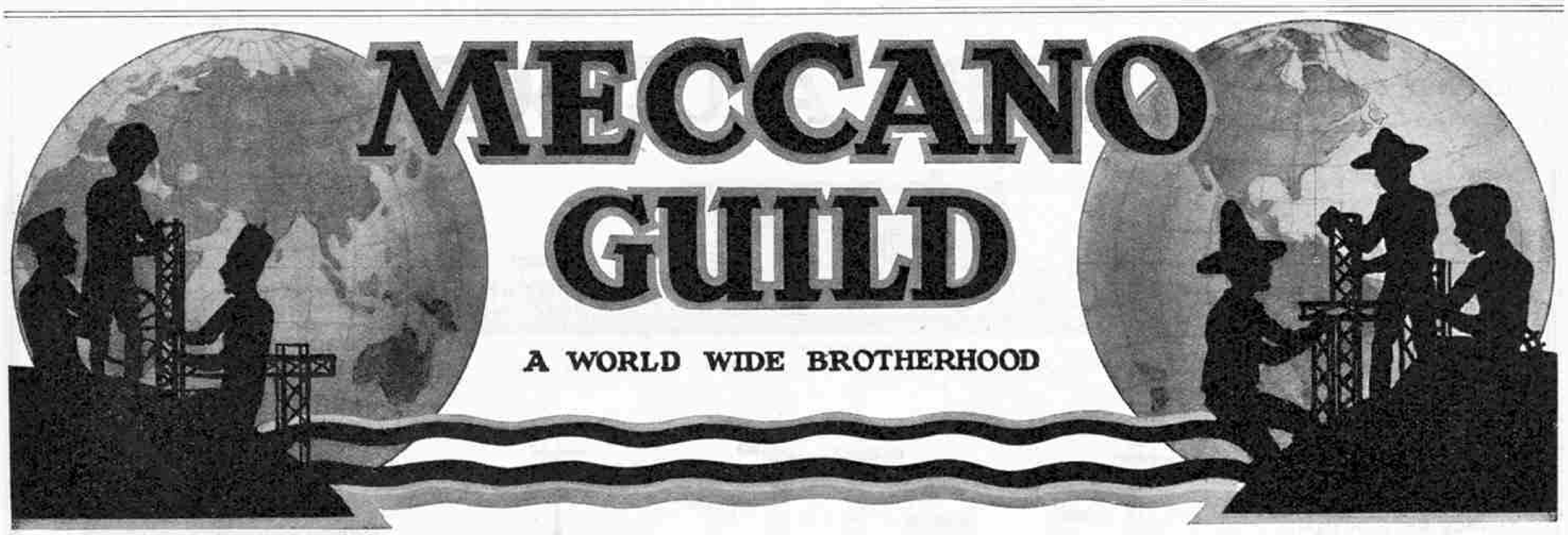
TREES
Oak Trees. **2½**d. each. Poplar Trees. **2**d. each.
DIE-CAST STANDS FOR TREES **1**d. each.



POSTER BOARDS
Designed to carry Hornby Posters in Miniature. They are provided with lugs for attachment to Paled Fencing, etc.
Packet of 6 (3 large and 3 small). Price **6**d.

VIADUCT. Price **7/-** **VIADUCT ELECTRICAL.** Price **8/-**
VIADUCT. Centre Section only. Price **4/9**
VIADUCT (electrical). Centre Section only ... ... Price **5/3**

MECCANO LTD. — BINNS ROAD — LIVERPOOL 13



The Climax of a Winter's Work

Now that the days are getting longer, the thoughts of club members naturally turn more and more to outdoor pursuits, and these predominate in the programmes for the coming months. Work in the club room of course is still going on, and in many respects the month's activities form the climax of the steady progress of the winter sessions, the results of which are revealed to parents and friends by means of Exhibitions and displays of various kinds. Meccano club functions continue to attract increasing numbers of visitors, who are surprised and delighted by the evidence placed before them of the resource and skill of members.

Plans for the outdoor sessions should now be well in hand if they are to be really successful. This is realised in most clubs, and I hope that the officials of others will lose no time in settling the general type of programme to be followed and in definitely fixing as many details as possible. If this is not done, difficulties are sure to arise that will ruin the best intentions and efforts to provide an attractive programme. On the other hand those who look ahead and allow time in which to think out ways and means of carrying a programme into effect, or of widening its scope, will reap the advantage of their forethought in a pleasant and happy outdoor season, and also in an increase in keenness and enthusiasm when the time again comes round for returning to club room activities.

Building Up Reputations

It is natural at this time of the year to look backward on the sessions just concluded, and to review the various items of club work in an endeavour to decide upon their value to club life. Attention to detail of this kind is essential, for successful programmes are built up on experience; but equally valuable results will follow careful thought over the impression made by clubs on those not connected with the movement. To-day club activities have become news, and an increasing number of excellent reports, often accompanied by good photographs, are published in newspapers in various parts of the country. Sometimes admiration of these efforts is only temporary, however, and Leaders should strive to maintain interest among those who have learned of club activities from these sources.

The most lasting impression of the value of Meccano clubs is made by the actions of members themselves. The support given by parents and friends of members is evidence that they appreciate the work of the clubs, and the greatest care should be taken to keep all who are directly interested well informed of progress. For this purpose members should be made to realise that the club exists not only to provide them with splendid fun and recreation, but also to encourage them to develop their own powers and to share their advantages with others. If every member becomes fully conscious of the importance of his own share in maintaining the good name of Meccano clubs, the movement will receive more encouraging support, in the press and elsewhere.

Meccano Club Secretaries

No. 29. R. Bellchambers

R. Bellchambers has been secretary of the New Bradwell M.C. since its affiliation in March, 1932, and his keen and active interest has been largely instrumental in its success. A remarkably varied and interesting programme is followed, including Model-building Contests, Hornby Train operations, football and several indoor games, and camping holidays are organised during the summer sessions.

Regular Reports Aid Recruiting

An experienced official of a successful overseas club recently wrote to give me details of a recruiting campaign that he is organising, and I was very pleased to read in his letter that he finds the best recruits are those who are impelled to join his club by reading reports of its activities in "Club Notes." This is a striking confirmation of the value of reports, and adds emphasis to my requests to secretaries to make these as full as possible and to forward them regularly, and to Leaders not to overlook this important side of club work. Those who are already members of a club are greatly encouraged by the regular appearance of accounts of their activities, and there can be no better means of conveying to Meccano enthusiasts some idea of the enjoyable times that club members have than a description of recent activities which show that a club really is alive.

The Correspondence Club

Recently there has been an increase in interest in the Correspondence Club, and many new Meccano Guild friendships have been formed between those who have taken advantage of the scheme. Scarcely a week goes by without the arrival at Headquarters of a letter from a member describing the pleasure he derives from reading letters from a friend overseas. One of the most interesting of these reached me a week or two ago from a Guild member in Glasgow, who told me that he has been writing regularly for nine years to a member in the Federated Malay States. Both correspondents look forward eagerly to the arrival of news from overseas, and the friendship formed nine years ago shows every sign of continuing with unabated interest.

I could give many other instances of the delights of correspondence between Meccano enthusiasts in various parts of the world, and I urge every Guild member to join the Correspondence Club at once. Members living in Australia, South Africa, New Zealand, the United States, Canada and France are awaiting correspondents in Great Britain, and new members also are required in Italy, Denmark and Holland, and even as far afield as China.

* * * *

The 10th Annual Concert of the Holy Trinity (Barnsbury) M.C. will be held on the 19th of this month. An interesting programme has been arranged and prizes awarded during the past sessions will be presented. This year the club's Annual Exhibition will be held in October, instead of in May, as in recent years.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places, and boys interested should communicate with the promoters whose names and addresses are given here:

AYLESBURY—C. Gustavus, 133, Wendover Road.
AYR—F. McEwen, Belleisle House, Ayr.
EASTLEIGH—G. Walsh, 30, George Street.

HORNBY SERIES

HORNBY ACCESSORIES

GAUGE O

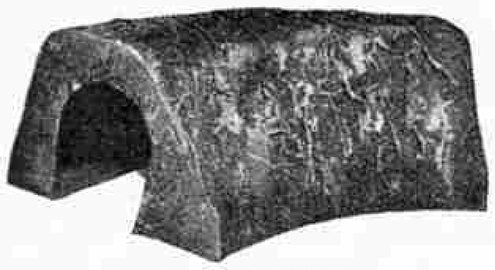
TUNNEL No. 0 (Straight)
Length 6 in., width 6⅛ in.
Price **1/6**

TUNNEL No. 1 (Straight)
Length 7 11/16 in. Width 6¼ in. (as illustrated).
Price **2/-**

TUNNEL No. 2 (Straight)
Length 15⅛ in. Width 9¼ in. Price **4/-**

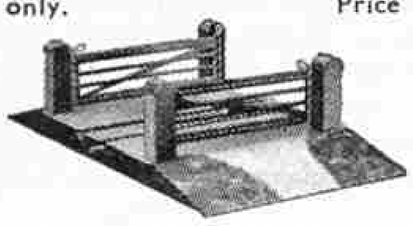
TUNNEL No. 5 (LEFT-HAND CURVED)
(as illustrated)
This tunnel is in the form of a small hill, through which the track runs obliquely. For 2 ft. radius tracks.
Base measurement: 15⅞ in.x14¾ in.
Length of track 17½ in. Price **7/6**

TUNNEL No. 6 (RIGHT-HAND, CURVED)
Similar to No. 5 Tunnel, but with track in the reverse position. For 2 ft. radius tracks only. Base measurement 15⅞ in.x14¾ in.
Length of track 17½ in. Price **7/6**



TUNNEL No. 3 (Curved)
Length 13 in. Price **4/6**

TUNNEL No. 4 (Curved)
(as illustrated)
Length 20 in. For 2 ft. radius tracks only. Price **5/6**

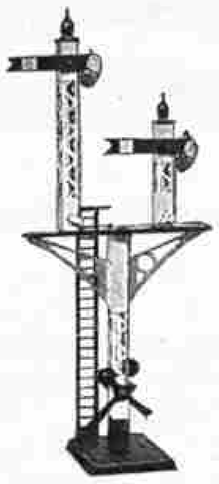


LEVEL CROSSING No. 1
Suitable for a single track only and has gauge O rails in position.
Price **3/6**

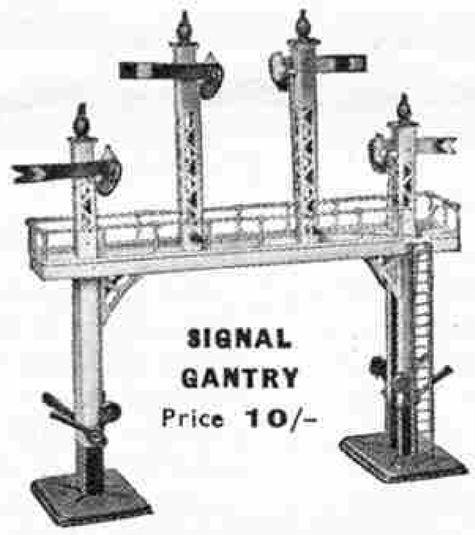
LEVEL CROSSING No. 2
Measures 13½x10¼ in., with two tracks of gauge O rails in position. Price **5/6**

LEVEL CROSSING No. E2 (Electrical)
Similar to Level Crossing No. 2 excepting that a third rail is fitted in each of the two tracks.
Price **7/6**

STATION No. 2
Excellent model, beautifully designed. Built up in three detachable sections.
Length 2 ft. 9 in., breadth 6 in., height 7 in. Price **10/-**

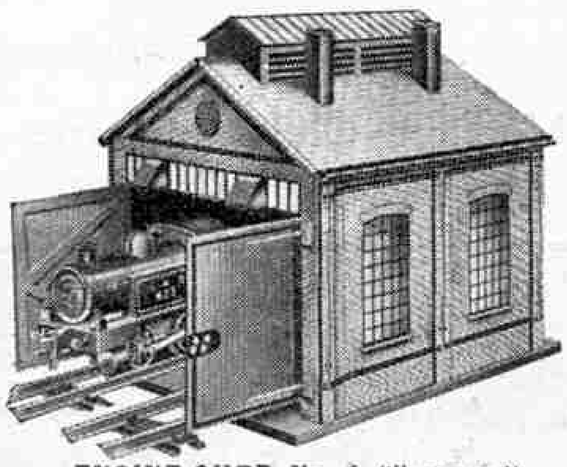


JUNCTION SIGNAL
"Home" or "Distant," Signal arms operated by levers at base. A very realistic model.
Price **6/-**



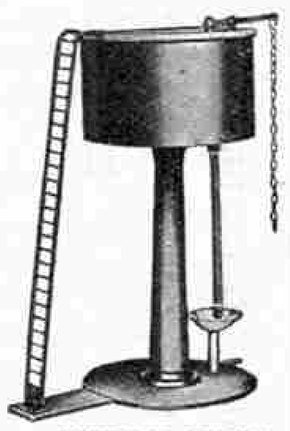
SIGNAL GANTRY
Price **10/-**

TELEGRAPH POLE
Price, per pair **4/-**



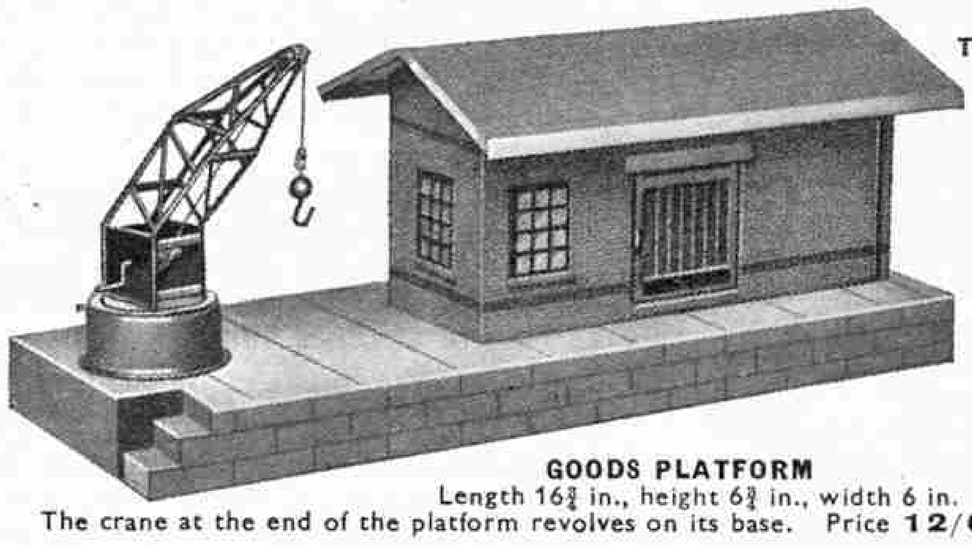
ENGINE SHED No. 1 (illustrated)
This Shed will accommodate Locomotives and Tenders of the M Series and No. 1 Tank and No. 1 Special Tank Locomotives.
Price **15/-**

ENGINE SHED No. 2
This Shed will accommodate any Locomotive and Tender in the Hornby Series.
Price **22/6**



WATER TANK
Fitted with flexible tube and valve lever.
Price **8/6**

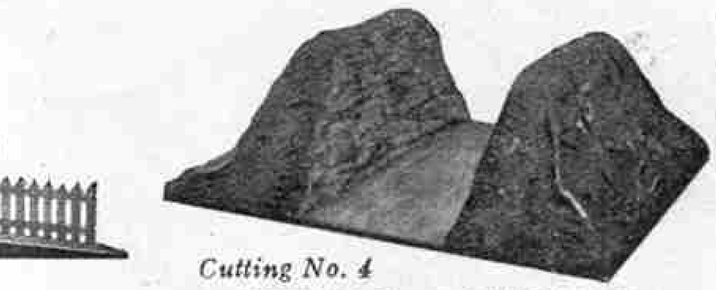
STATION No. 1
Length 16¾ in., width 6 in., height 6 in. This Station is a well-made model, richly finished in bright colours. By placing several of these Stations at intervals along the track, and using the Railway Station No. 2 as the main terminus, a very realistic effect is given to a miniature railway layout. Price **6/-**



GOODS PLATFORM
Length 16¾ in., height 6¾ in., width 6 in.
The crane at the end of the platform revolves on its base. Price **12/6**

M TELEGRAPH POLE No. 2
Price 4d. each.

TURNTABLE No. 2
Price **4/6**



Cutting No. 4

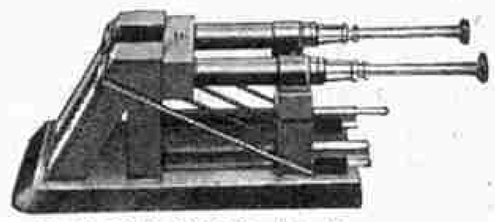
CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement: Length 15⅜ in., width 15 in. Price **6/-**

Two No. 1 and one No. 2 Cuttings are illustrated here.

CUTTING No. 1 (END SECTION)
(illustrated)
Base measurement: Length 7 11/16 in., width 6 in.
Price, per pair **3/-**

CUTTING No. 2 (CENTRE SECTION, STRAIGHT)
(illustrated)
The addition of these centre sections enables a Hornby Railway cutting to be extended to any length. They are intended to be used in conjunction with the End Sections (Cutting No. 1) between which they are fitted.
Base measurement: Length 10½ in., width 6 in.
Price **2/-**

CUTTING No. 3 (CENTRE SECTION, CURVED)
This is used for curved tracks in the same manner as the straight centre section, described above, is used for straight tracks. It is suitable for both 1 ft. and 2 ft. radius tracks. Price **2/-**



BUFFER STOPS No. 2
(Hydraulic type). Price **5/6**

SIGNAL CABIN No. 1
Finished in colours. Price **2/9**

SIGNAL CABIN No. 2 (illustrated)
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price **4/6**

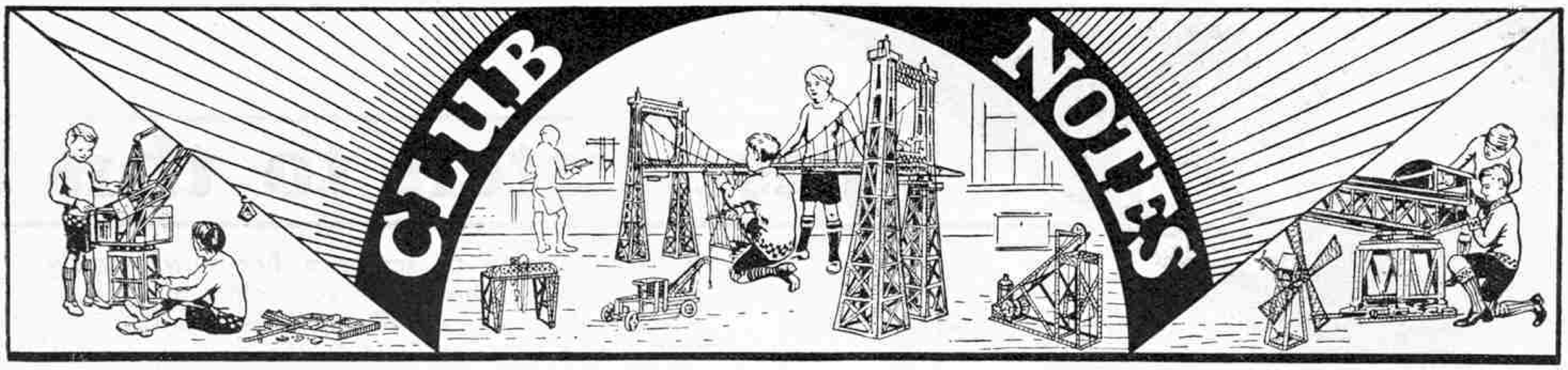
No. 1 FOOTBRIDGE, WITHOUT SIGNALS
Price **4/-**

No. 1A FOOTBRIDGE, COMPLETE WITH SIGNALS Price **4/9**

No. 2 FOOTBRIDGE, COMPLETE WITH DETACHABLE SIGNALS
(as illustrated). Price **7/6**

Signals only (for Footbridge No. 2)
Price, per pair **3/9**

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13



Exeter M.C.—Enthusiasm remains at a high level and a remarkable series of models of all types have been constructed by members. Special interest is being taken in architectural models, and many of the members have forwarded entries in the contest for models of this type recently announced in the "*M.M.*" A special feature has been made of a model of Exeter Cathedral, which has been exhibited locally and greatly admired by hundreds of people. Club roll: 39. *Secretary:* D. Legg, 25, Chute Street, Newtown, Exeter.

King's Lynn M.C.—The club room has been redecorated and refurnished, and members derive great entertainment from the wireless outfit and electric gramophone placed at their disposal. Experimental electricity work is making good progress, and members are busy on a large switchboard to control the accumulator charging plant and the motor that drives the woodworking machines. The club has joined the King's Lynn and District Table Tennis League, and the matches are being greatly enjoyed. Club roll: 22. G. D. V. Dey, Dock Offices, King's Lynn.

Old Charlton M.C.—Recent meetings have been devoted to Simplicity Contests and to special Model-building, Breakdown Cranes and models illustrating constructional principles having been constructed. A special meeting was devoted to questions on the use of Meccano Parts and the applications of Meccano generally, and to a talk on "*The Port of London Authority*," kindly given by Mr. Cooke. Club roll: 19. *Secretary:* B. Stevens, 53, Mount Street, Charlton, London, S.E.7.

Anderson Baptist M.C.—Members are very keen on introducing schemes that will make the programme livelier and more attractive. The proceeds of the recent successful Annual Exhibition are being applied to the purchase of Meccano Outfits and Meccano Accessory Parts in order to enable the range of model-building to be extended. The club has been divided into sections, and each section is to be equipped to enable it to work independently. Club roll: 27. *Secretary:* R. E. Hoffler, 27, Pitcroft Avenue, Reading.

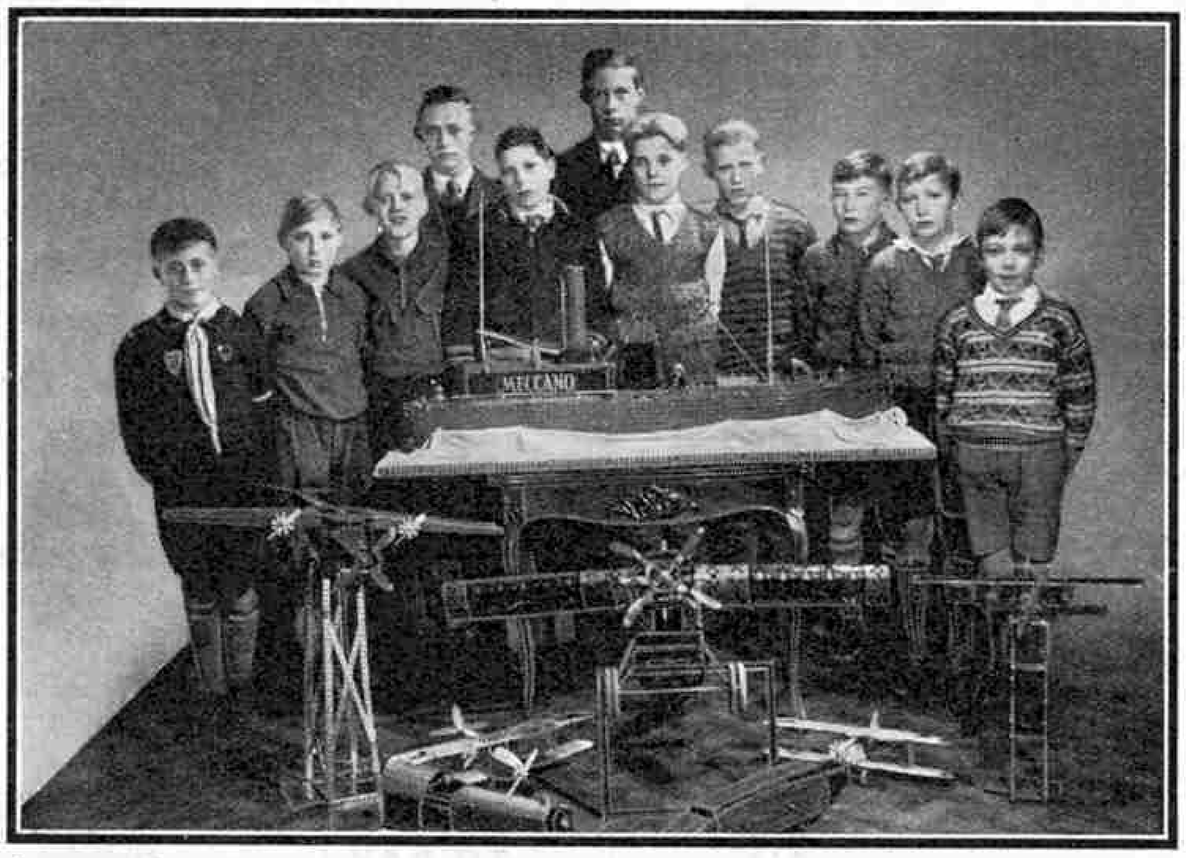
Chertsey M.C.—Cycle Runs have been arranged when the weather has been favourable, and on one particularly enjoyable outing members visited Virginia Water and Laleham. Indoor work has included the construction of a Lift and a Tramcar by officials of the club. These models have been employed for demonstration purposes. Unfortunately the club is at present without a suitable meeting place, but individual Model-building is carried on with unabated enthusiasm, and a special Contest for models built at home has been arranged. It is hoped that a suitable room will soon be obtained. Club roll: 14. *Secretary:* E. V. Brown, Arbon Grove Cottage, Lyne, Chertsey, Surrey.

St. George's (Edinburgh) M.C.—The club room is open every night, but regular meetings are held weekly. At most meetings short talks on such subjects as "*Famous Bridges*" and "*Schools*" are given, and are followed by discussion. The remaining time is devoted to Model-building and to track laying and train operation, except when lectures have been arranged. Games Meetings also are held, and members are collecting books and games for distribution among members of clubs in other parts of the city. The first number of "*The Mechor*," the club's magazine, has been issued. Club roll: 93. *Secretary:* A. Matheson, 18, Hutchison Terrace, Edinburgh.

Bridport Grammar School M.C.—A popular programme of Model-building and Games Evenings is being followed. Stamp Collecting has been introduced and the section organised in connection with this hobby promises to be an attraction to members. The Library has proved very successful, and members have contributed very generously to the stock of books available. Club roll: 33. *Secretary:* H. Dommett, West Allington, Bridport, Dorset.

Worcester Y.M.C.A. M.C.—Meccano Nights are held every Saturday, and special meetings for gymnastic exercise and games are arranged on Tuesdays and Fridays. A miniature Billiards Table has been obtained, and a Library has been started and already consists of more than 50 volumes. A Model-building Contest was arranged at the beginning of the year, together with a Club Supper and Social. Preparations for the club's Exhibition kept members busy, and their hard work was rewarded by a great success. Club roll: 17. *Secretary:* R. G. Price, 60, Bath Road, Worcester.

Braintree High School M.C.—The Annual Exhibition was held in the School Assembly Hall, the Meccano Model Display occupying one side of the Hall, and the Hornby Train Layout being on the opposite side. The Meccano Display consisted of a Sawmill, with suitable forest scenery around it, and a Dock to which logs were transported by road and rail for shipment. Special attention was paid to lighting, and the entire scene had a very attractive appearance. The models on view were judged by a local engineer, who spoke highly of their merits. A collection realised £1 18s. 0d., and the club is greatly indebted to the Governors and Headmaster of the school for their kind assistance in making the Exhibition a success. Club roll: 22. *Secretary:* M. K. Miles, 1, Wordsworth Road, Bocking, Braintree.



A group of members of the Hilversum M.C., with Mr. E. v d. Vorst, secretary, on the left of the back row. This enterprising Dutch club was affiliated in April, 1933, when it numbered only six members. Splendid progress has been made under the skilful guidance of Mr. F. Eisenberger, the Leader, and remarkably realistic models of increasing size and complexity have been built.

Harlesden Methodist M.C.—Aeroplane and Motor Car Sections, each under a capable leader, have been formed and Meccano enthusiasts interested in these topics are invited to become members. Mr. Smedley, Assistant Leader of the Club, gave an attractive talk on "*Argentine Railways*," illustrating his account by means of original photographs. On Model-building Evenings Tractors, Cranes and Searchlights have been built, and great interest was displayed in building models with the aid of a Meccano Motor Car Constructor Outfit. The Stamp Section is holding excellent meetings, and a Members' Social proved very enjoyable, members being particularly interested in the effects brought about by a Shocking Coil! Club roll: 13. *Secretary:* J. A. Ford, 139, Wakeman Road, Kensal Rise.

Hornsea M.C.—Splendid meetings have been held under the direction of Mr. R. W. Shooter, Leader of the Club. These have included Cinematograph Exhibitions, Hornby Train Nights, and Debates, during which members developed their ideas on the League of Nations and other interesting topics. Lantern Lectures have included talks on the "*Great War*" by Mr. Barnard, and one on the "*Steam Engine*" by Mr. N. Bird. Club roll: 75. *Secretary:* L. Chapman, "Cleveleys," Red Roofs, Hull Road, Hornsea.

Middlesbrough M.C.—Many excellent Motor Cars, Motor Lorries, Cranes and other models were on view at the club's Exhibition, together with working models kindly loaned by local dealers and a Hornby Train layout. The Exhibition was very successful, and voluntary donations by visitors realised 5/1. Model-building is pursued with keenness by all members, and after every meeting a First Aid demonstration is arranged by Mr. J. Senior, Leader of the club, and Mr. A. Lambert. Morse Code Signalling also is being practised. Club roll: 38. *Secretary:* L. Weighell, 42, Bishopton Road, Middlesbrough.

John Gulson Senior Boys' School (Coventry) M.C.—Interesting Model-building Contests have been arranged. Simplicity Contests are particularly attractive to members, who have submitted excellent miniature reproductions of Vacuum Cleaners, Telephones, Aeroplanes and Railway Engines. A Table Tennis Tournament has been held, and members also are greatly interested in books on constructional work and hobbies, and bring their copies to club meetings for the benefit of others. An amusing but instructive debate was held on the question "*Should Policemen or Robot Signals be used for Road Traffic Control?*" Club roll: 17. *Secretary:* H. Ludgate, 46, Fynford Road, Radford, Coventry.

Mary Swanwick School (Chesterfield) M.C.—An attractive series of meetings for model-building purposes has been varied by a Lecture by Mr. Pearson on "*Model Aeroplanes and Gliders*," illustrated by demonstrations, and a Pie Supper, when refreshments kindly provided by Mrs. T. E. John were supplemented by contributions of members. Preparations are being made for a week in Camp at Whitsuntide, a School Camp having been kindly placed at the disposal of members. Club roll: 15. *Secretary:* T. W. Cooper, Bull's Head Hotel, Old Whittington, Chesterfield.

Falmouth Wesley M.C.—The varied programme has included Model-building, Debates, Lectures, Games Evenings and Socials. The football team is having an excellent season. Membership is rapidly increasing under the capable leadership of Mr. F. Hopkins, who kindly accepted the position a few months ago, and a Concert has been organised by friends of the club in order to raise funds for its activities. Club roll: 29. *Secretary:* W. T. Allen, 7, Marlborough Road, Falmouth.

AUSTRALIA

Sydney M.C.—The club's second birthday was celebrated by a Social arranged by the Parents' Club, at which a very enjoyable time was spent. A visit has been paid to Nestlé's Chocolate Factory, and a film showing operations at the Steel Works of Bradford Kendall Ltd., has been shown. Other meetings have been devoted to Model-building, and to a particularly valuable Lecture by Mr. A. Lord, President of the club, on "*Gears*." Club roll: 12. *Secretary:* W. J. T. Watson, 595, Parramatta Road, West Leichhardt, N.S.W., Australia.

NEW ZEALAND

Blenheim M.C.—Model-building Contests and Games Competitions have been chief recent activities. Simplicity Contests are favourites with members, and one in which a time limit of 20 minutes was imposed was specially interesting. Unfortunately Mr. A. W. Taylor has been compelled to resign Leadership owing to pressure of business. Club roll: 18. *Secretary:* K. J. Orams, Redwood Street, Blenheim, New Zealand.

Club Not Yet Affiliated

Toronto Central Y.M.C.A. M.C.—The club has been reorganised and members have constructed a model 10 ft. in length of a Suspension Bridge. This is remarkable for the detail reproduced and aroused great interest when exhibited. Other models built have included a Sailing Vessel and a Hammerhead Crane. Talks have been given on "*The Construction of an Aeroplane*" and "*Stephenson's Link Motion.*" Club roll: 11. *Secretary:* B. Moore, 141, Albertus Avenue Toronto 12, Ontario, Canada.

Just listen to this !

NEW HORNBY LOCOMOTIVES FOR OLD

Here is a plan to secure a fine new Hornby Locomotive in exchange for your old one.

First of all, study carefully the latest Hornby Train Catalogue, and select from it the new up-to-date Hornby Locomotive you want. Then pack up your old Hornby Locomotive and send it to us addressed "Special Service Department," Meccano Ltd., Binns Rd., Liverpool 13. Your order for the new Locomotive and the necessary remittance should be enclosed. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the list given here from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase. It is important to note that the catalogue price of the new Hornby Locomotive you purchase MUST NOT BE LESS THAN DOUBLE THE PART EXCHANGE ALLOWANCE MADE FOR YOUR OLD LOCOMOTIVE.

If you prefer to do so, you can effect the exchange through your dealer, who will be very pleased to give you any further information you require.

Part Exchange Allowances for Hornby Locomotives

CURRENT TYPES

MO Locomotive	1/4
M1/2 Locomotive	2/3
M3 Tank Locomotive	3/9
No. O Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
LEC 1 Locomotive (Swiss Type)	7/6
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
LST M3/20 Tank Locomotive (20-volt)	11/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
LST 1/20 Tank Locomotive (20-volt)	12/6
LE 1/20 Locomotive (Swiss Type), 20-volt	13/3
LE 2/20 Locomotive (20-volt)	16/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera "Blue" Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera "Blue" Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan L.V. Locomotive	20/–

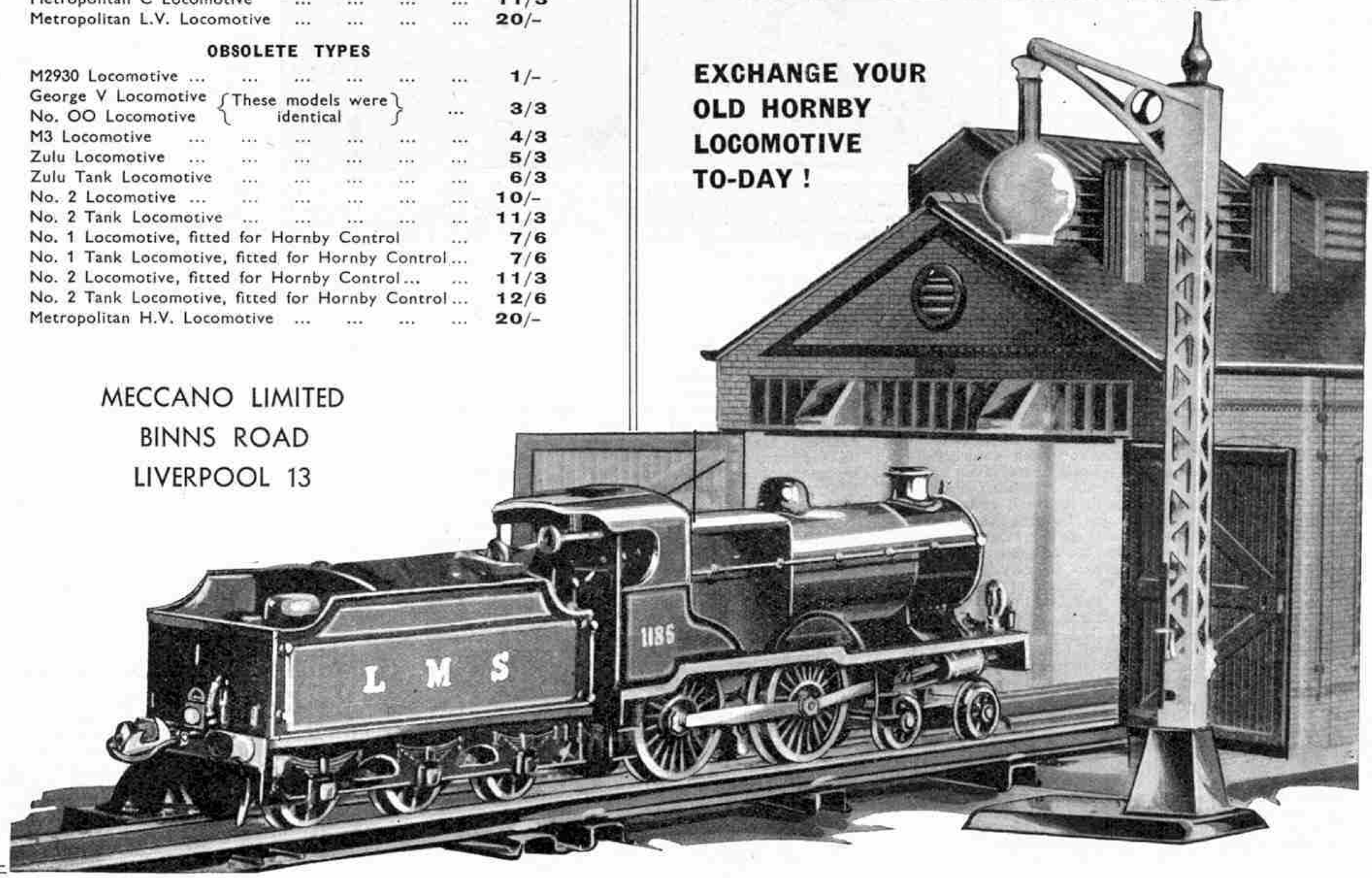
OBSOLETE TYPES

M2930 Locomotive	1/–
George V Locomotive, No. OO Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan H.V. Locomotive	20/–

MECCANO LIMITED
BINNS ROAD
LIVERPOOL 13

HORNBY TRAINS

EXCHANGE YOUR OLD HORNBY LOCOMOTIVE TO-DAY !



Branch Notes

WOODFORD.—Track meetings are held regularly and special attention is paid to the condition of the track, work of this kind being well repaid by steady running without derailments. A special "Branch Week" has been held, when meetings were held every night and devoted to track operation, games and competitions and practically every activity in which members are interested. Secretary: J. H. Skelt, Walberswick, Woodside Road, Woodford Wells, Essex.

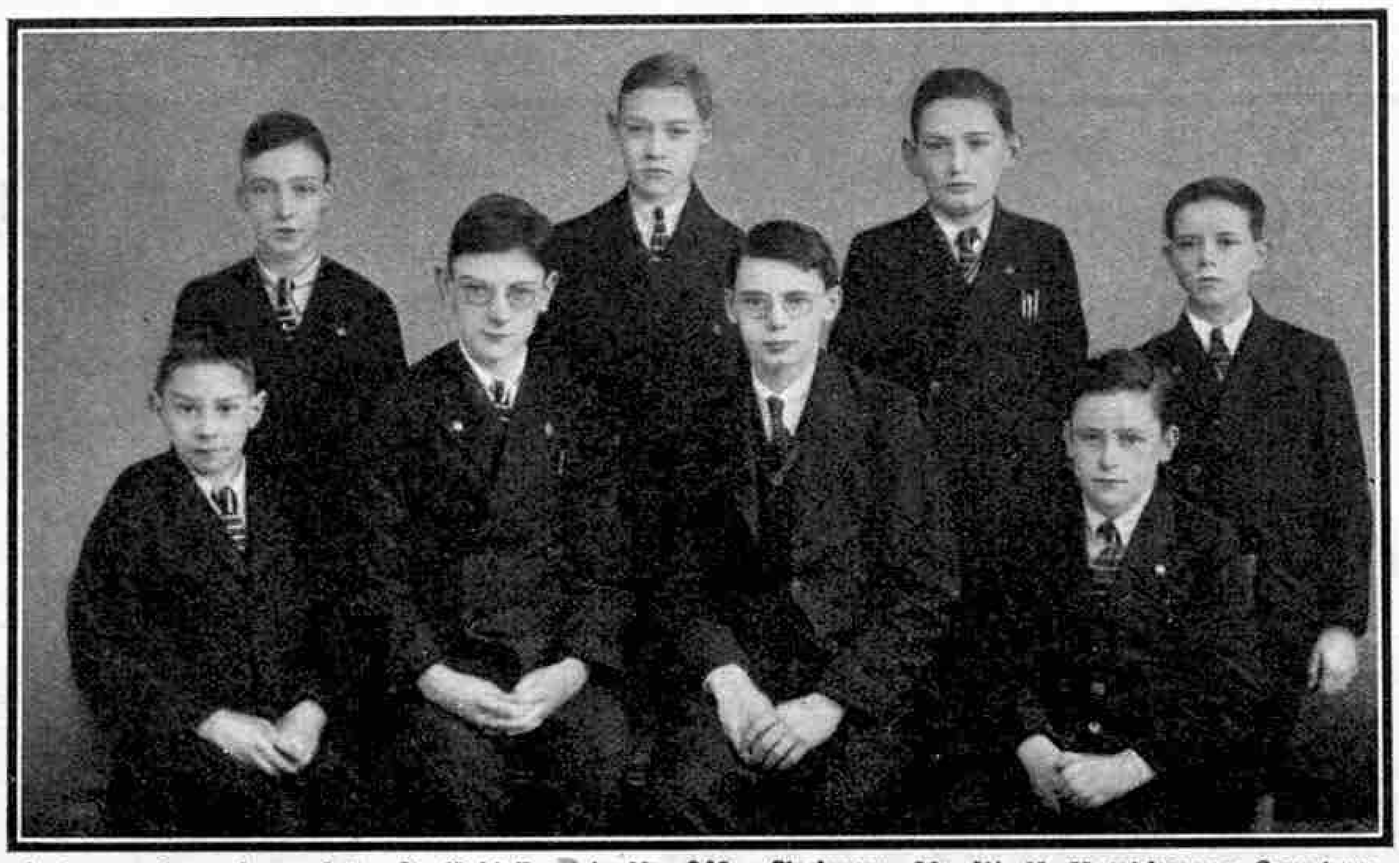
SHEFFIELD.—Membership is increasing satisfactorily, but new members are still required, and those interested should apply to the secretary. Track work is carried on regularly, and continual additions are being made to the layout. Part of the track is shortly to be electrified, and the completion of this will present interesting problems in the arrangement of timetables. A Magazine is to be produced and a Library has already been started. Competitions and Cinema Entertainments have been features of other meetings, and other events have included a visit to the L.N.E.R. Goods Yard, and the operation of a large Hornby electric layout in a central store in the city. Secretary: W. B. Hutchinson, 35, Linden Avenue, Sheffield, 8.

ST. GEORGE'S (EDINBURGH).—The Branch track has now been assembled. It is laid down on boards and can rapidly be lifted up after each meeting, and almost as quickly replaced. Interesting track operations have been supplemented by Shunting Competitions and similar contests, in which the younger members took part. Special meetings have included a Mock Trial and a Social. A very interesting programme is followed, and this has aroused so much interest that a new Branch room will be necessary before further new members can be enrolled. Secretary: A. Matheson, 18, Hutchison Terrace, Edinburgh.

KIDDERMINSTER.—Work is now carried on in a Branch room 60 ft. in length in which a track with two termini has been laid down on boards. The terminal arrangements afford interesting and complicated working in both passenger and goods departments, and plans for the erection of railway works are under consideration. Further extensions of the track are necessary in order to accommodate the rolling stock at the disposal of the Branch. Mr. W. Barker, Chairman of the Branch, has been compelled by ill health to retire, and his position has been taken by Mr. C. R. Harris, founder of the Branch. Secretary: E. Haines, "Railway House," Prospect Hill, Kidderminster.

BELFORT (CATFORD).—The programme is exceptionally varied and interesting. On Track Nights trains made up in accordance with true railway practice are operated under the control of a superintendent, and Competition Night is devoted to railway problems. A Table Tennis Tournament created great excitement, and a match against a local Scout Troop was won by 15 games to 10. Promising recruits have been secured, and these spend a period of probation before being elected members. Secretary: J. H. Forth, "Gleneagles," 31, Ardoch Road, Catford, London, S.E.6.

LYONSDOWN.—A new Branch room is in use, and trials have been carried out in order to find the type of layout best suited to the space available, and for operation by the number in membership. At track meetings members are paired off, and each pair is given a section of the layout to superintend, prizes being awarded to those who show the best results. There is room for new members, and the secretary will be glad to hear from anyone interested in miniature railway work. Secretary: D. Edington, Normandhurst, Lyonsdown Road, New Barnet.



A group of members of the Sheffield Branch, No. 249. Chairman, Mr. W. H. Hutchinson; Secretary, W. B. Hutchinson. The Branch was affiliated in July last year, and has followed an excellent programme in which operations on a well-designed layout have been the principal feature.

AUSTRALIA

PARRAMATTA.—The Branch has now settled down in its new quarters and intensive track work is being carried out. Electric lights have been installed in the stations and buildings incorporated in the layout, and all points are being worked from lever frames in signal boxes equipped with tapper bells for bell code working. Automatic staff exchanging and slip coach working are other additions under consideration. Members wish to exchange postcard size photographs of Australian locomotives for similar photographs of those of other countries, and railway enthusiasts interested are asked to write to the Secretary: H. H. Matthews, 27, Ross Street, Parramatta, Australia.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:

CHESTERFIELD—D. Westall, 3, Cromwell Road.

DONCASTER—N. F. Ayres, Field Road, Thorne.

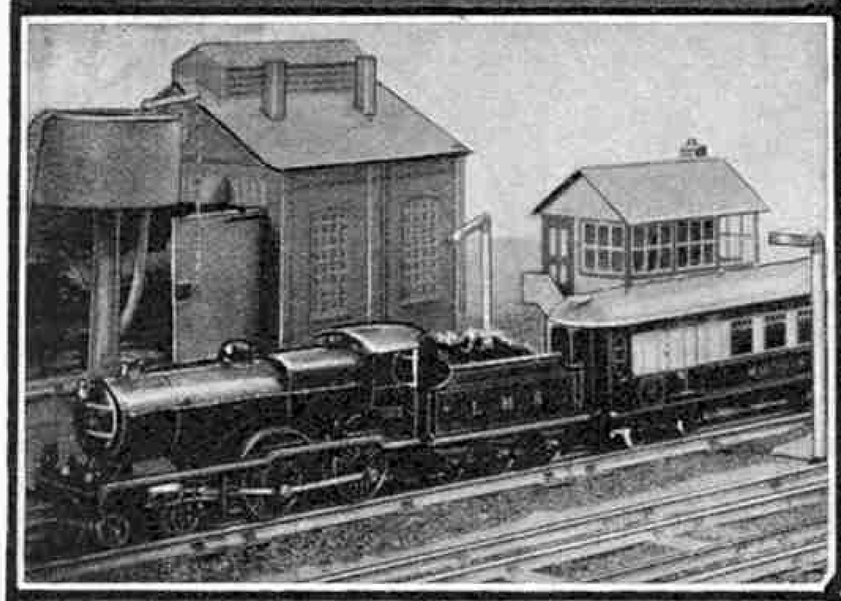
LEEDS—John F. Sharpe, 12, Hessle Road, Welton Road, Headingley, 6.

LONDON—R. N. Faulkner, Otterton, Minchenden Crescent, Southgate, N.14.

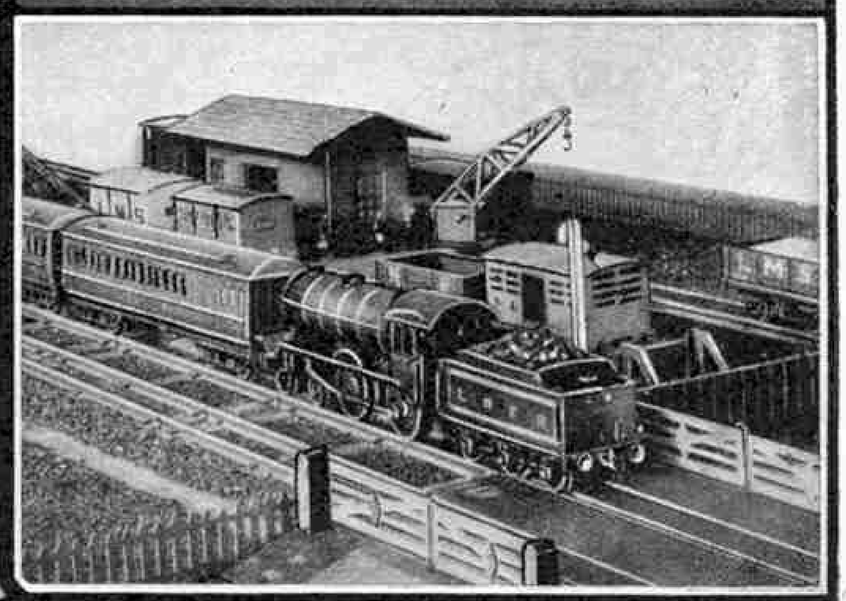
LONDON—A. R. Wardle, 25, Limes Avenue, New Southgate, N.11.

Branches Recently Incorporated

257. PRIORY—J. T. Cosgrove, 54, Priory Road, High Wycombe.
258. WALLINGTON COUNTY COUNCIL—P. R. Brown, 4, Westcroft Road, Carshalton.
259. CENTENARY (GOOLE)—P. Heslehurst, 1, Airmyn Avenue, Goole.
260. KING EDWARD VI GRAMMAR SCHOOL—J. Pullen, 104, Gaia Lane, Lichfield.



HOW TO GET MORE FUN FROM HORNBY TRAINS

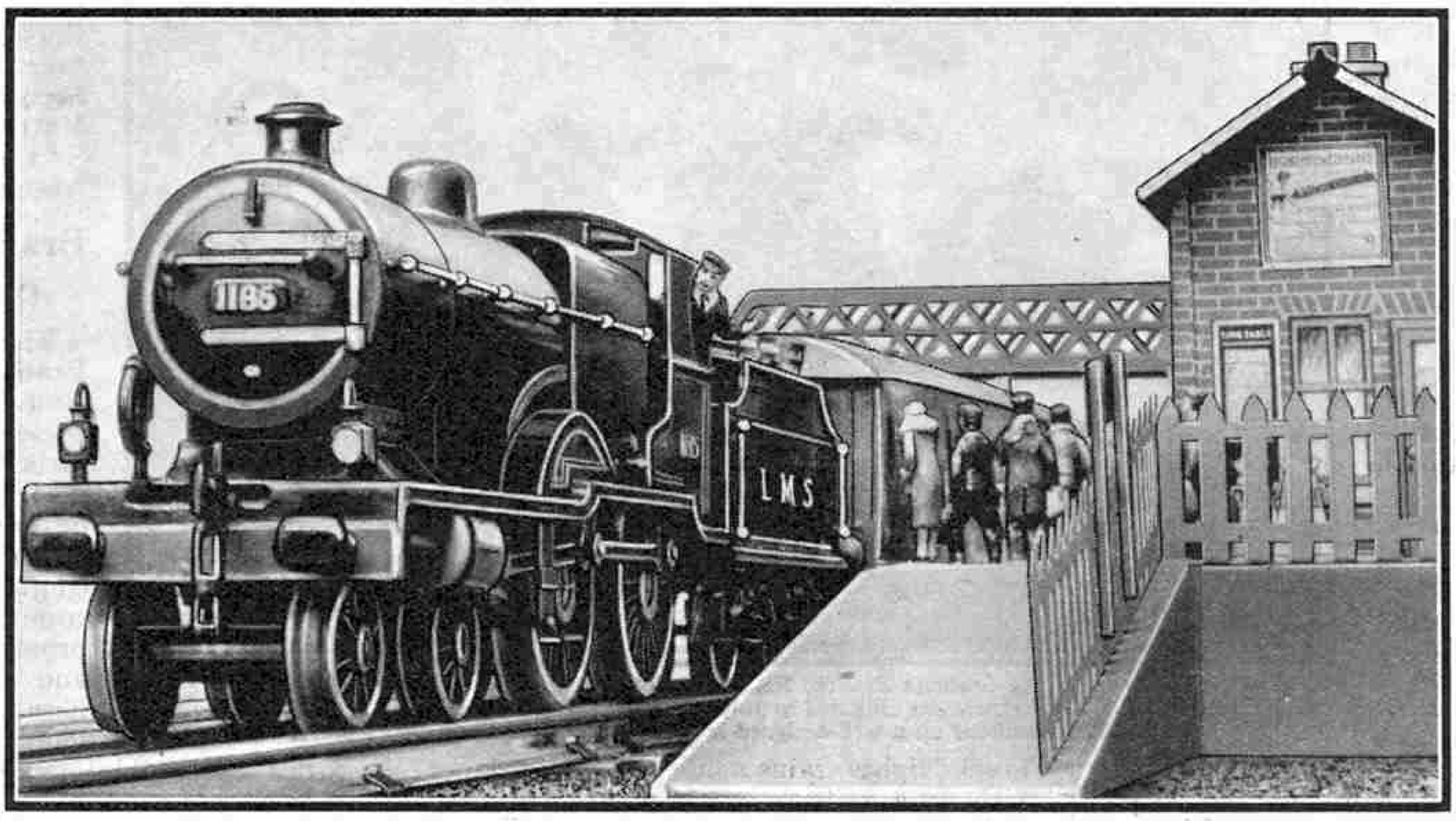


LXVI.—MINIATURE "TILBURY" TRAINS

IN most of the articles that have appeared in the "*M.M.*" dealing with the reproduction in miniature of features of the working of various railway groups or sections, main line routes and traffic have received the chief attention. This month we propose to deal with a section of the L.M.S.R. that exhibits peculiar characteristics of its own. Its tank engine operation, the heavy and intensive character of its train services, its marine connections, and other special interests such as the recent extension of electrification, all combine to make the London, Tilbury and Southend line one worthy of attention.

Certain features in operation that characterised the line in its independent days as the London, Tilbury and Southend Railway still persist, although modifications have necessarily occurred owing to the passage of time since its amalgamation with the Midland Railway in 1912 and its subsequent incorporation in the L.M.S.R. For instance, a peculiarity of the independent line was that it owned only two tender engines, and to-day the chief duties are still carried out almost exclusively by tank engines. The reason for this widespread use of tanks is that none of the runs is of great length.

This feature makes the line specially suitable as a prototype for a miniature system, where the advantages of tank engines are numerous. They do not take up as much room as tender engines of corresponding types, which makes it possible for locomotive depots, sidings and stations to be planned on a somewhat smaller scale. It is not essential for tank engines to be turned at the end of each trip in order to run chimney foremost, so that a turntable is not an essential fitting. This ability to run in either direction with equal ease is of course one of the most obvious features of tank engine operation, though modern practice does not favour the running of large engines bunker first for long distances. Where a turntable is to be provided on a Hornby layout, it is useful to remember that the largest Hornby Tank engines—the No. 2 Special 4–4–2 Tank and the corresponding electric type—can be accommodated by the No. 2 and No. 2E (Electrical) Turntables.



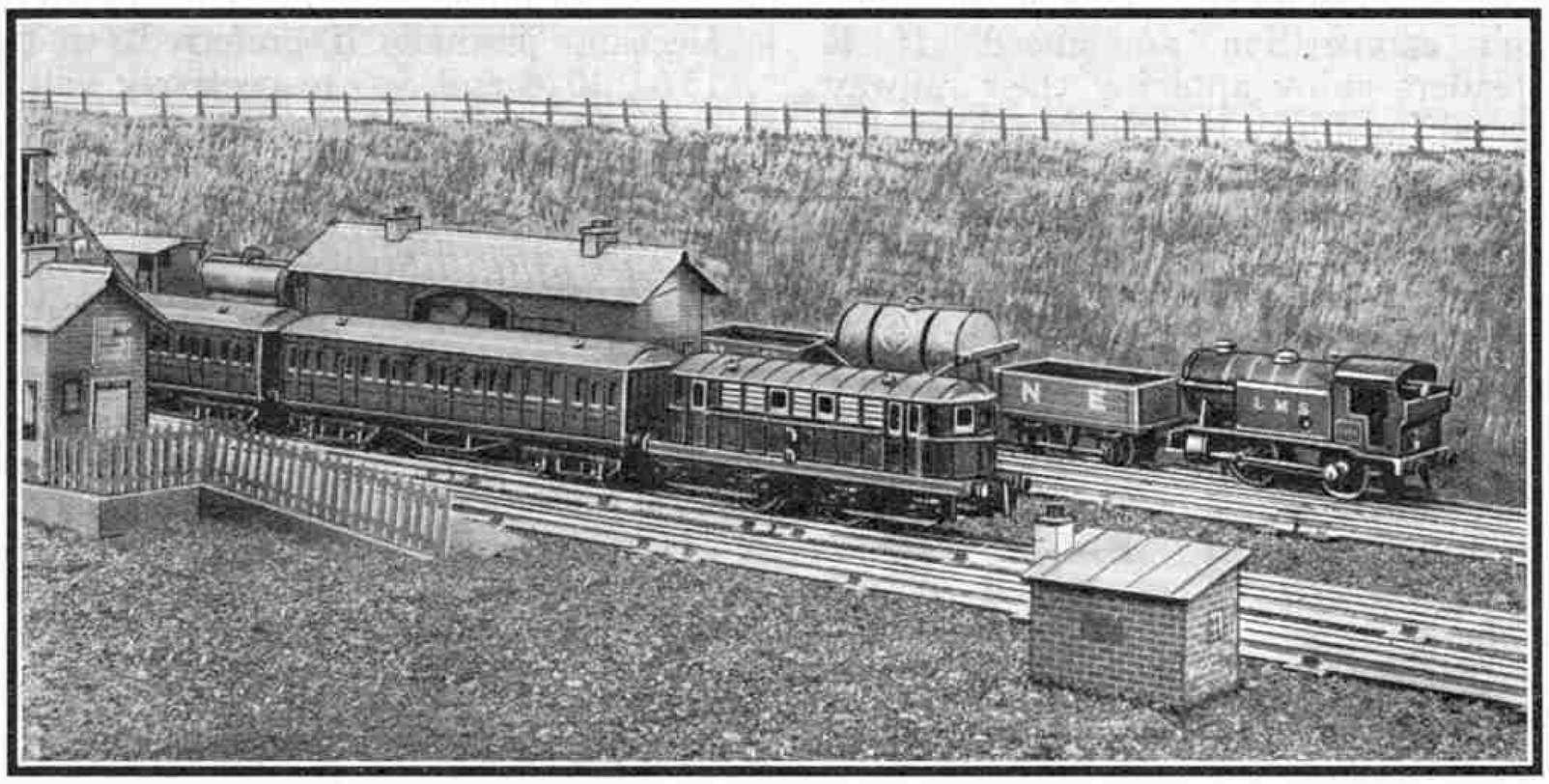
A Hornby Midland Compound Locomotive at the head of an express. Main line tender engines appear on through trains to the Tilbury section so that the engine illustrated can be used correctly on miniature L.T. & S. layouts.

The predominant wheel arrangement on the Tilbury section is the 4–4–2; in fact at one time locomotives of this type were exclusively employed for all varieties of traffic, both passenger and goods, thus earning the name of "universal" engines. There is therefore every reason for the employment of the largest Hornby Tanks of this wheel formation to carry out Tilbury duties in miniature. The other smaller Hornby types may also be employed of course, and on less elaborate layouts they will probably be the principal engines.

An interesting result of the fact that the Tilbury line has no terminus of its own in London and for its main services has to run into the L.N.E.R. station, Fenchurch Street, is that locomotives and stock in L.N.E.R. colours may be represented on the same layout. Joint working of this kind is very attractive, and it appeals to many owners of Hornby miniature railways. The point from which the Tilbury line running powers into Fenchurch Street operate is known as "Gas Factory Junction," which should be represented if at all possible on miniature Tilbury layouts.

A greater variety in the locomotives to be seen on the Tilbury line was brought about as a result of the

amalgamation with the Midland, and grouping has had further effects in this direction. On through and special duties, therefore, such standard types as the Midland Compounds are used, and such working can be paralleled in miniature by the use of the L.M.S.R. No. 2 Special tender locomotive. One of these appears in the illustration on page 328 and forms an interesting contrast with the tank types in the other photographs. Excursions to Southend from the Western Division of the L.M.S.R. are often worked through by engines of that section, so that miniature locomotives representing suitable classes may appear as often as the demands of traffic make it necessary.



Electric and steam type trains at work on a Hornby railway. This illustration is representative of a typical portion of a model railway based on the electrified section of the Tilbury line.

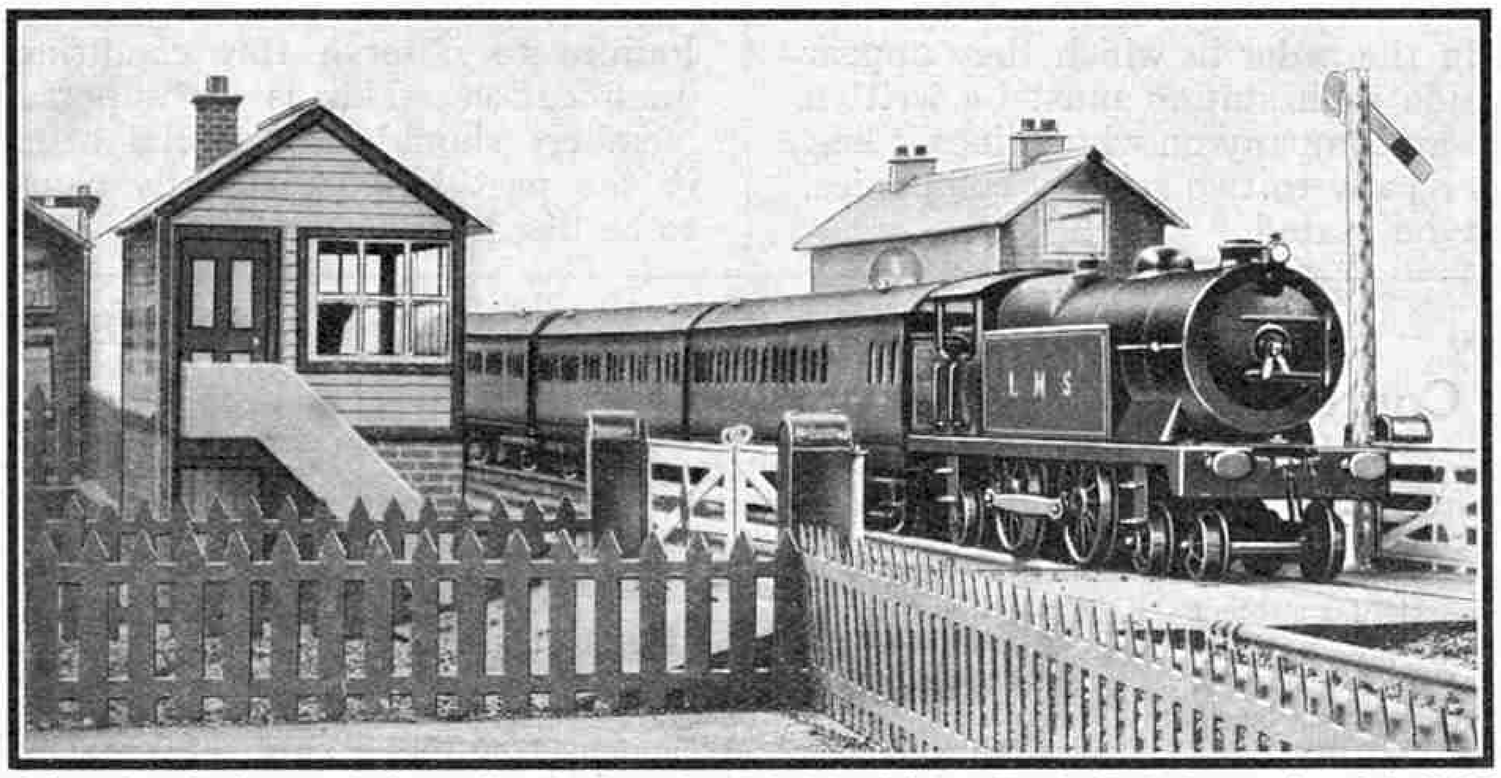
A very heavy residential traffic passes over Tilbury metals from Southend, Westcliff and Leigh up to Fenchurch Street, and of course in the opposite direction. Very smart working is demanded of the locomotives by the schedules, and some heavy loads are taken. Provision should therefore be made for the reproduction of this characteristic in miniature by planning the working timetable to cope with "rush-hour" traffic in the up direction in the morning, with a correspondingly heavy return in the evening. This traffic is largely carried by set trains in actual practice, and in miniature these can be readily formed of No. 1 Coaches, close-coupled, as mentioned several times previously on these pages.

Special interest has been added to the Tilbury section by the extensive widenings undertaken recently, and the completion of the electrification programme from Barking to Upminster. This work completes schemes that were first proposed many years ago. The first step leading to this electrification was the opening as long ago as 1902 of the Whitechapel and Bow lines connecting the Metropolitan District system with the Tilbury line. Through working of trains from one system to another thus became possible, an interesting example being a service from the District line through to Southend for which special vestibuled stock was introduced. These trains are worked by two District electric locomotives to the limit of the electric system, and are then handed over to a Tilbury steam locomotive for the rest of the run.

This combined working of two motive powers makes its reproduction in miniature of particular interest. Even where the propelling force is the same, as on a completely clockwork or all-electric layout, locomotives of different outlines, as in real practice, can be employed. The upper illustration on this page shows a section of track where a Hornby Metropolitan train, representing the District locomotive-operated service, is leaving a station, while a goods train "steam"-hauled by the L.M.S.R. tank engine suggests the Tilbury section.

The through vestibuled trains referred to previously can be made up very well of Hornby No. 2 Saloon Coaches in L.M.S.R. colours, for these are of the centre corridor type and can be connected together by their miniature gangways in the proper manner. When hauled by a Hornby No. 2 Special Tank, such a train will have quite an important appearance; and for running over the electrified section of the journey, with a Metropolitan engine at its head, it will be equally interesting.

By means of the Tottenham and Forest Gate line the Midland and Tilbury systems were put into direct communication 40 years ago, thus making possible the accommodation of Tilbury trains at the Midland terminus of St. Pancras. A service of through trains is operated to-day in this manner, so that actually two London terminal stations are available for Tilbury services, a point that is of interest in the modelling of the system. Boat trains that connect with steamer sailings at Tilbury are invariably despatched from St. Pancras, and trains of this kind add to the variety of operations in miniature. The provision of the necessary marine facilities at the station representing Tilbury should not be overlooked.



A fine view of a heavy suburban train of bogie stock. This is hauled by a Hornby Tank Locomotive of the 4-4-2 type, a wheel arrangement in common use on the line described in this article.

Trains of this kind that run through from the Midland section may be made up of No. 1 Coaches or No. 2 Saloon Coaches, as preferred, according to the rolling stock that is available. The operation of these trains will provide a reason for the employment of a variety of locomotives to represent the various Midland and L.M.S.R. types.

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Meccano Ltd., Binns Road, Liverpool 13. The name, address and membership number of each competitor should appear in clear writing on the back of every sheet of paper used.

HIDDEN STATIONS CONTEST

The popularity of hidden words contests seems to increase with each competition announced. It is evident that our readers enjoy applying their railway knowledge and general ingenuity in tracking down the hidden words, and there is no doubt that there is a great fascination about such contests. This month we announce a "*Hidden Stations Contest.*" It is exactly one year since we had a competition of this kind, and therefore we shall expect to receive a very large entry.

In the panel in the centre of this page are 24 words in which various dashes represent missing letters. Each of these queer-looking words forms part of the name of a British railway station, and we set H.R.C. members the pleasant task of identifying the names of these stations. There is no catch in any of the words; in spite of appearances each one will be found to form part of the name of a railway station. The names of the stations we have chosen are not well known, and therefore we think that members will have much more fun in trying to identify them. All the names are to be found without difficulty in "Bradshaw," or other railway timetables.

When competitors have discovered all the correct stations, or as many of them as they can find, they must make a list of them in the order in which they appear in the panel. Alongside each station must be written the initials of the railway company on whose lines it lies. If the station belongs jointly to two railway companies, both companies must be stated.

–l a – – g a r –	B – – l – n – s h – – s –
G – – n – e	C – – p – e – y
– – v – l – f – – l –	Ba – c – u r – h
T a – a – r –	W – e – –
P – – n – – l	R – t – l e –
– b e – d – u –	– t – n – i – h
W – e d – –	P i – – s h i – –
– s – i – l –	M – – c – t –
– a – l e –	B – l – o – b –
E – – a m	– n – w – – t – e
B – – i l – t	N o – – h o – – e
– e l – – d – n	C – – r l – u – y

Prizes consisting of Hornby Train material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded. For each mistake made by the competitor one mark will be deducted from the total number awarded, so that the prizes will be awarded to those boys whose solutions contain the least number of mistakes. In the case of a tie for any prize preference will be given to the competitor whose attempt is presented in the most novel or ingenious manner. In addition to the main prizes a number of consolation prizes will be awarded to the entries, which although below prizewinning standard, are nevertheless praiseworthy efforts to tackle the contest.

Envelopes containing entries must be clearly marked "*H.R.C. April Hidden Stations Contest*" in the top left-hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 30th April. Entries from Overseas readers must reach this office not later than 31st July. Any entry received later than the published dates cannot be entertained.

On the back of every entry submitted for this contest must be clearly indicated the sender's name and full address, and also his H.R.C. membership number. Failure to observe this condition will result in disqualification. This is an important feature to which members should pay special attention, as its neglect in the past has occasionally caused promising entries to be discarded.

Railway Photographic Contest

Commencing with this issue we shall announce each month until September a railway photographic contest. Correspondence has shown that competitions of this kind limited to one particular subject are not as popular as those with a wider range. Therefore we have decided to make these competitions quite open, prizes being offered for the best photograph of "*Any Railway Subject.*"

Competitors may send as many prints as they desire, but no competitor can win more than one prize in one contest.

The contest will be divided as usual into two Sections—Home and Overseas—and prizes of Hornby Train or Meccano products to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the best entries in each Section.

Envelopes containing prints should be clearly marked "*H.R.C. April Photo Contest,*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, not later than 30th April. The Overseas closing date is 31st July.

Drawing Contest

Continuing the series of Drawing Contests that commenced in January, and which have proved so popular, we announce this month a similar contest for which we have chosen as the subject a familiar sight to all travellers by train, "*A Platelayer At Work.*"

To the senders of the four best entries received in each Section, Home and Overseas, prizes will be awarded consisting of Hornby Train or Meccano goods to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition a number of consolation prizes will be awarded to those senders whose entries do not come up to competition standard. The sender's name, full address and H.R.C. membership number must be written on the back of each entry. Omission of the H.R.C. membership number from any entry will cause it to be disqualified.

Envelopes containing entries must be clearly marked "*H.R.C. April Drawing Contest*" in the top left-hand corner, and posted to reach Meccano Ltd., Binns Road, Liverpool 13, on or before 30th April. Overseas closing date, 31st July.

COMPETITION RESULTS

HOME

January "Mutilated Names Contest."—Owing to the large number of correct solutions sent in for this Contest, the prizes have been awarded to the senders of the neatest and most novel entries. First: E. BEVEN (35158), Birley Carr, Sheffield. Second: R. COULING (28701), Southall, Middx. Third: E. A. TAYLOR (25924), North Harrow, Middx. Fourth: J. D. HOUSE (31596), Forest Hill, London, S.E.23. Consolation Prizes: R. LUMLEY (20253), Swilley, Plymouth; W. S. ARNOTT (18451), Edinburgh; E. S. SANT (12928), Streatham, London, S.W.16; C. W. FOSTER (26961), Southall, Middx.

January "My Favourite Loco Contest."—First: E. B. SIMPSON (36342), Spondon, Nr. Derby. Second: R. BARBARY (5580), Mevagissey, Cornwall. Third: J. L. WHITE (9240), Hendon, London, N.W.9. Fourth: R. E. TROTTER (17873), Loughborough.

January "Drawing Contest."—First: J. MACKEN (23826), Bromley, Kent. Second: G. WARD (25437), Silloth. Third: J. SISSEN (37774), Preston. Fourth R. A. E. KEELER (37698), Thorpe Bay, Essex.

OVERSEAS

October "Impossible Train Contest."—First: W. S. EAGLE (31779), Byculla, Bombay, India. **Second:** N. A. BURT (35228), Murchison, New Zealand. **Third:** J. STANBRIDGE (10236), Perth, Western Australia. Fourth: M. DE LIMA (34925), Bombay, India. Consolation Prizes: A. A. TIBBETTS (24271), P.O. Kapue, Northern Rhodesia, S. Africa; W. J. T. WATSON (18065), West Leichhardt, N.S.W., **Australia.**

October "Questions Contest."—First: RENÉ PASCAUD (29988), France. Second and Third (Tie): R. A. WRAGG (7913), India. W. J. T. WATSON (18065), Australia. **Fourth:** G. E. SCHULZ (15425), **Australia.**

An Interesting Layout in New Zealand

The Miniature Railway of Mr. F. Roberts

THE photographs on this page show parts of an interesting miniature railway that has been constructed by Mr. F. Roberts of Auckland, New Zealand. It is electrically operated, and as the locomotives and rolling stock have all been made by the owner, who is himself a railwayman, it is natural that they should represent prototypes with which he is familiar.

The line is arranged partly indoors and partly outside, a scheme that has many advantages over the wholly indoor or outdoor line. For instance, as in this case, the terminus can be under cover indoors, where complicated track-work and crossings, signalling connections and other intricate equipment, are protected from the weather, and where the actual terminal buildings can be made more detailed than is possible out of doors.

Interesting views on the miniature railway described on this page. (Left) A double-headed train crossing a deep gorge. (Centre) A realistic tunnel mouth and viaduct. (Right) A local train arriving at a wayside station.

Rapata," the terminus of this line, situated in the basement, whence the ne emerges into the open country of the arden. This outside portion lies among ealistic scenery, as the photographs show ; and the most has been made of the opportunities that presented themselves for the incorporation of bridges, viaducts and other engineering features. The lineside effects are very fine, not only in features directly concerned with the railway itself, but also in houses and other buildings placed in appropriate positions. Quite a small township is clustered about the indoor terminal station.

Complete electrical control over the system is provided, and it is interesting to note that the various switches for different purposes have been laid out so as to resemble the fittings in an actual locomotive cab, so that the chief operator gets a very real impression of " driving the train " when in charge of operations. Control is necessarily divided, as the line is partly inside and partly out, and the trains are passed through the hands of successive controllers by means of bell signals as in actual practice.

The most important station is " Rapata " terminus. From the start the railway runs among realistic surroundings, and further on, yet still in the suburban area, is the important station of " Stewartville." This has a large shunting yard, and the station buildings are of an imposing nature. Here is situated the locomotive depot, with coaling plant and water tank. As an example of the completeness of detail that is typical of the line it may be mentioned that the engine shed is even fitted up with miniature inspection pits between the rails, duly white-washed as in actual practice. A sharp incline and a tunnel lead the track out of doors into the country section. As a result of this separation of the terminus from the main outside track the impression of distance is more easily conveyed to the onlooker than is possible where the complete line is arranged within a comparatively limited space indoors. The effect of the whole railway is thus considerably enhanced. A typical wayside station is shown in the right-hand illustration on this page, where a train is just drawing in.

The line is laid in the manner usual overseas, with flat-bottomed " Vignoles " rails spiked to sleepers which, except on bridges, are covered with ballast. The centre third rail supplies current to the locomotive, and the return path is by means of the running rails, the necessary insulation being provided by the wooden sleepers.

A varied stud of locomotives provides motive power, all of them being based on New Zealand prototypes. Those of the older and perhaps more interesting classes are very ornate. Some of them are of special interest, their polished brass domes and " balloon" type spark-arresting chimneys being a feature. Other characteristic fittings are the large headlights and the " pilots " or cowcatchers. The engines are beautifully finished, and are as satisfactory in performance as they are in appearance.

MECCANO

Dinky Toys

Boys, Meccano Dinky Toys are the most realistic and the most attractive models in miniature ever produced. They are made of the best material obtainable, and are all finished in beautiful colours.

Many of these toys are ideal for giving the finishing touch to your model railways. You must have railwaymen to deal with your trains, and passengers to travel in them; car attendants to look after the passengers, and engineers for the maintenance of the railway and its equipment. You want farmyard animals for lineside fields, and you should have at least one of the famous "Hall's Distemper" advertisements alongside your line!

Then there are the miniature train sets, rail autocar and various other types of motor vehicle. You can have hours of fun running these on the table or on the floor, arranging road and rail transport services from one point to another.

These splendid toys may all be purchased separately at the prices shown, or they may be obtained in complete sets. Ask your dealer to show you the complete range of Meccano Dinky Toys.

Meccano Dinky Toys No. 1
STATION STAFF

No. 1a	Station Master	... ...	each	3d.
No. 1b	Guard	... ...	,,	3d.
No. 1c	Ticket Collector	... ...	,,	3d.
No. 1d	Driver	... ...	,,	3d.
No. 1e	Porter with bags	...	,,	3d.
No. 1f	Porter	... ...	,,	3d.

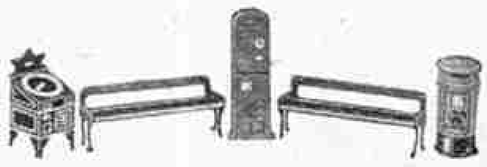
Price of complete set 1/6

Meccano Dinky Toys No. 4
ENGINEERING STAFF

No. 4a	Electrician	... ...	each	3d.
No. 4b	Fitters	... ...	,,	3d.
No. 4c	Storekeeper	... ...	,,	3d.
No. 4d	Greaser	... ...	,,	3d.
No. 4e	Engine Room Attendant		,,	3d.

Price of complete set 1/6

Railway Accessories No. 1
MINIATURE LUGGAGE AND TRUCK
Price of complete set 1/6



Railway Accessories No. 3
PLATFORM MACHINES, Etc.
Price of complete set 1/6
Railway Accessories No. 4
This set contains all the items that are included in Railway Accessories Nos. 1, 2 and 3.
Price of complete set 3/9

Meccano Dinky Toys No. 3
PASSENGERS

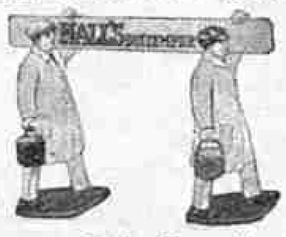
No. 3a	Woman and Child	...	each	3d.
No. 3b	Business Man	... ...	,,	3d.
No. 3c	Male Hiker	... ...	,,	3d.
No. 3d	Female Hiker	... ...	,,	3d.
No. 3e	Newsboy	... ...	,,	3d.
No. 3f	Woman	... ...	,,	3d.

Price of complete set 1/6

Meccano Dinky Toys No. 5
TRAIN AND HOTEL STAFF

No. 5a	Pullman Car Conductor		each	3d.
No. 5b	Pullman Car Waiters	...	,,	3d.
No. 5c	Hotel Porters	... ...	,,	3d.

Price of complete set 1/3



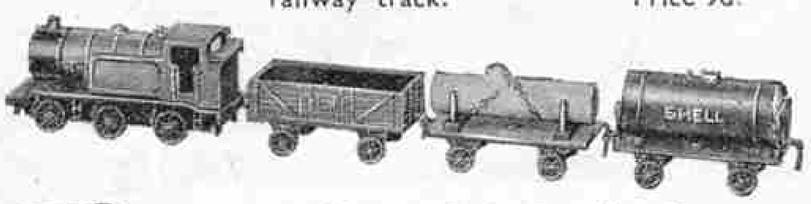
Meccano Dinky Toys No. 13
HALL'S
DISTEMPER ADVERTISEMENT
This miniature of a well-known line-side advertisement is intended to be placed in the fields adjoining the railway track. Price 9d.

Meccano Dinky Toys No. 18
GOODS TRAIN SET

No. 21a	Tank Locomotive	...	each	9d.
No. 21b	Wagons	...	,,	4d.

Price of complete set 1/9

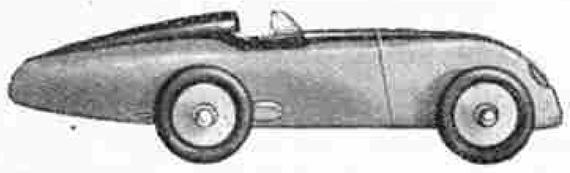
Railway Accessories No. 2
MILK CANS AND TRUCK
Price of complete set 1/6



Meccano Dinky Toys No. 19
MIXED GOODS TRAIN SET

No. 21a	Tank Locomotive	...	each	9d.
No. 21b	Wagon	...	,,	4d.
No. 21d	Petrol Tank Wagon	...	,,	6d.
No. 21e	Lumber Wagon	...	,,	5d.

Price of complete set 1/11



Meccano Dinky Toys No. 23
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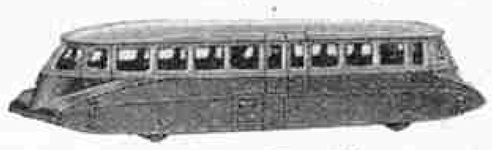
Assorted Colours. Fitted with rubber tyres.
Price 6d. each

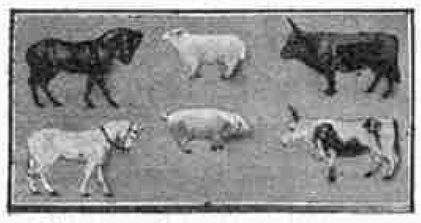
Meccano Dinky Toys No. 20
PASSENGER TRAIN SET

No. 21a	Tank Locomotive	...	each	9d.
No. 20a	Coaches	... ...	,,	7d.
No. 20b	Guard's Van	... ...	,,	7d.

Price of complete set 2/6



Meccano Dinky Toys No. 26
RAIL AUTOCAR
Assorted Colours ... ... Price 6d. each



Meccano Dinky Toys No. 2
FARMYARD ANIMALS

No. 2a	Horse, each 3½d.	No. 2c	Pig, each 2d.
No. 2b	Cow ,, 3½d.	No. 2d	Sheep ,, 2d.

Price of complete set 1/6

Meccano Dinky Toys No. 22
MOTOR VEHICLES

No. 22a	Sports Car each 6d.	No. 22d	Delivery Van each 8d.
No. 22b	Sports Coupé ,, 6d.	No. 22e	Tractor ... ,, 9d.
No. 22c	Motor Truck ,, 8d.	No. 22f	Tank ... ,, 1/-

Price of complete set 4/-

Meccano Dinky Toys No. 6
SHEPHERD SET

No. 6a	Shepherd ...	...	each	3d.
No. 6b	Dog	... ...	,,	3d.
No. 2d	Sheep	... ...	,,	2d.

Price of complete set 1/2

Meccano Dinky Toys No. 24
MOTOR CARS
Fitted with rubber tyres and silver plated radiators.

No. 24a	Ambulance	... ...	each	9d.
No. 24b	Limousine	... ...	,,	9d.
No. 24c	Town Sedan	... ...	,,	1/-
No. 24d	Vogue Saloon	... ...	,,	9d.
No. 24e	Super Streamline Saloon		,,	9d.
No. 24f	Sportsman's Coupé	...	,,	9d.
No. 24g	Sports Tourer (4 seater)		,,	1/-
No. 24h	Sports Tourer (2 seater)		,,	1/-

Price of complete set 6/6

Meccano Dinky Toys No. 28/1
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Hornby Trains Van ...	,,	9d.
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Oxo Van...	,,	9d.
Ensign Cameras Van ...	,,	9d.

Price of complete set 4/6

Meccano Dinky Toys No. 25
COMMERCIAL MOTOR VEHICLES
Fitted with rubber tyres and silver plated radiators.

No. 25a	Wagon ...	...	each	9d.
No. 25b	Covered Van	... ...	,,	9d.
No. 25c	Flat Truck	... ...	,,	9d.
No. 25d	Petrol Tank Wagon	...	,,	9d.
No. 25e	Tipping Wagon	...	,,	9d.
No. 25f	Market Gardener's Van		,,	9d.

Price of complete set 4/6

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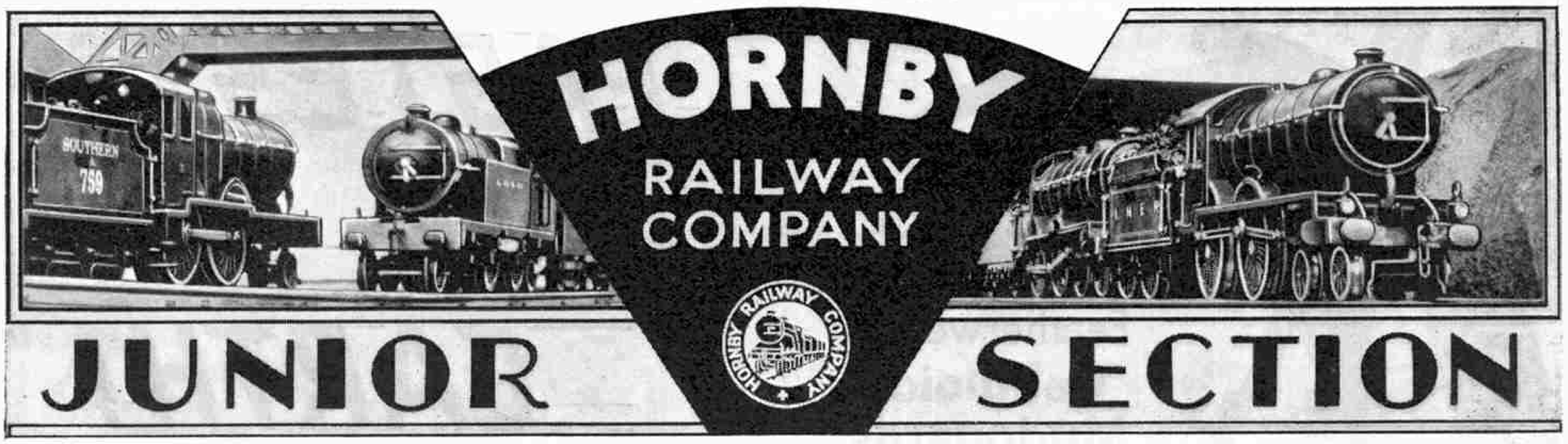


FIRST STEPS WITH A HORNBY RAILWAY

IT is probably correct to say that most miniature railway systems have their origin in the small circle or oval of rails included in the Train Set with which operations are commenced. The beginner, when viewing an elaborate layout, may have difficulty in following exactly how the various developments have taken place. A little acquaintance with the various rails, however, and some experience of their use, soon gives some idea of their possibilities. The purpose of this article is to discuss these possibilities with reference to the various layouts illustrated in these pages from time to time.

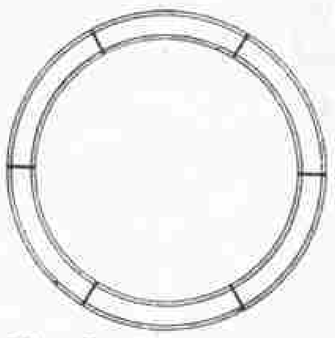


Fig. 1. Rails required (1 ft. or 9 in. radius): 6 Curves.

Taking first the layout in Fig. 1 the actual formations shown can be constructed with either 9 in. radius curves and points and the appropriate straight rails, or with corresponding 1 ft. radius rails and the standard straight rails. It is not advisable to attempt to combine the two in the same layout, however, and we will assume that 1 ft. radius rails are being used throughout.

The circular track shown in this illustration is the simplest layout possible. It is formed of six curved rails. The layout can therefore be easily separated into two half circles of three rails each, in order to allow of the first step in the expansion of the system—the introduction of straight rails, as shown by Fig. 2. Any number of straight rails may be added, according to the space that is available; but of course for every addition on one side of the layout a corresponding addition must be made on the other, otherwise the lines would not finally join up in a satisfactory manner.

Layouts of this kind are very useful for enabling beginners to get used to the management of their locomotives and rolling stock. When proficiency in this direction has been attained, the next desire will be for an extended layout that will enable this skill to be exercised more fully, and at the same time will allow fuller scope for the power and speed of the locomotive.

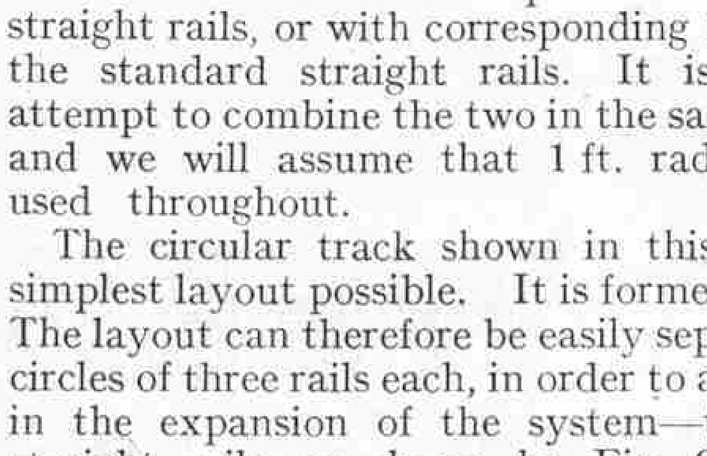


Fig. 3. Rails required (1 ft. or 9 in. radius): 7 Curves, 4 Straights, R.H. Points, L.H. Points.

The addition of points to the layout is the usual step, but beginners rarely obtain as much satisfaction from points as they might. The reason is that the actual effect of the addition of points is not fully appreciated, and this characteristic is by no means confined to beginners. The standard right-hand and left-hand turnout points are so arranged that their straight portions correspond exactly in length with the ordinary straight rails, and their curved branches in a similar manner agree in length and radius with the corresponding curved rails.

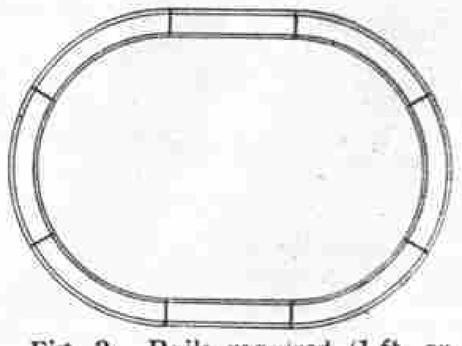


Fig. 2. Rails required (1 ft. or 9 in. radius): 6 Curves, 2 Straights.

This relation is shown in the layout in Fig. 3, which consists of a combination of the circular and the oval layouts already mentioned. The circle is obtained by adding right-hand and left-hand points as shown to the half-circle at one end of the layout. As the curved branches of these points correspond in length with a standard curved rail, only one more curve is required to complete the circle. Straight rails are now added to the straight portions of the points, and the oval track is completed by the half-circle of rails at the end. This track is more interesting than the plain circle or oval, for the addition of points gives a choice of routes that may be taken by the train according to the fancy of the operator.

Another possible development is shown in Fig. 4. Here the circle and the oval are combined again, but in a different manner, the circle being outside the oval, not inside as before. The points are applied to the layout so that their straight portions form part of the same side of the main oval, and their curved branches form adjacent sections of the same circular track, the remainder of the circle being made up of four curved rails.

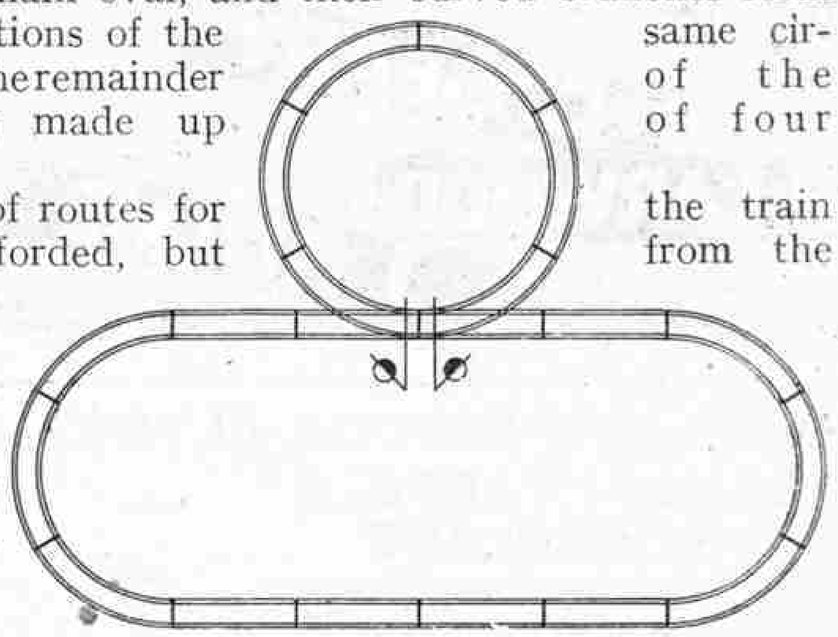


Fig. 4. Rails required (1 ft. or 9 in. radius): 10 Curves, 6 Straights, R.H. Points, L.H. Points.

A choice of routes for the train is again afforded, but from the operating point of view this layout is better than the previous one. Longer stretches of independent track are available, and the two points levers are close together, so that both points can be operated very conveniently. Continuous running over either system of track is possible, but with smart manipulation of the points levers the direction of the train may be varied from one to the other as required.

Bluemel's

Featherweight
Celluloid Mudguards
with quick-release adjustable fittings as low as

5/- per pair In black.

In white **5/9**

★ Every fellow should send for the interesting little list, post free from Bluemel Bros. Ltd., Dept. 27, Wolston, nr. Coventry. It illustrates 50 useful accessories for the bicycle, from 1d. to 7/6.

Name.....

Address.....

WRITE CLEARLY IN BLOCK LETTERS AS THIS [27]

FASTEST ON EARTH!

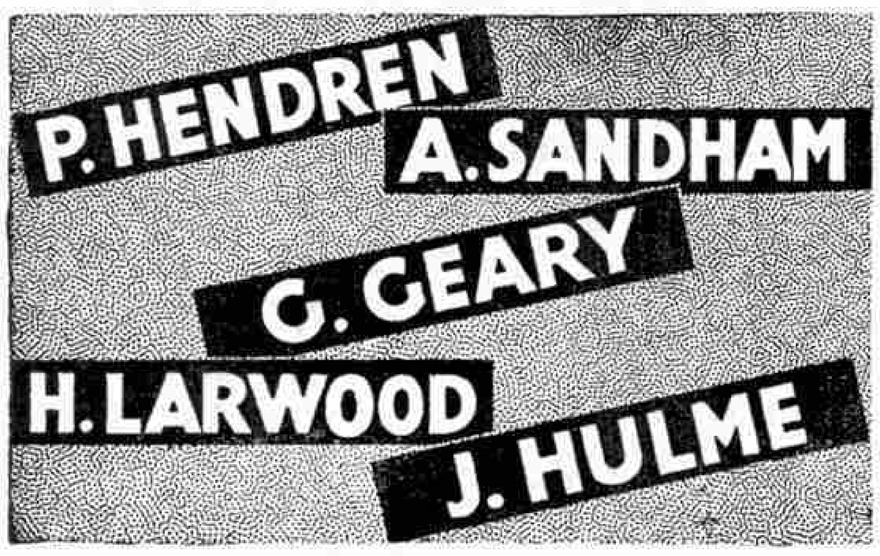
Pratts WITH ETHYL

ETHYL GASOLINE CORPORATION

the original high-compression anti-knock petrol

GAMAGES

GREAT CRICKET WEEK



These famous players will be here to give you free tuition and to help you improve your play. TWO FULL LENGTH PRACTICE NETS have been specially reserved for boys. A great display of cricket kit—bats, balls, pads, etc., will also be on view. In fact, a visit is the best preparation for the cricket season just beginning.

April 9th to 16th

BOYS' SELECTED SPRING HANDLE BATS

Size 3 **4/3** Size 5 **4/9**
„ 4 **4/6** „ 6 **5/9**

YOUTHS' SELECTED YORKSHIRE DRIVER

With treble rubber and cane handles, rubber grips, selected blades.

Size 4 **8/11** Size 6 **11/6**
„ 5 **10/6** Narrow Size **16/6**

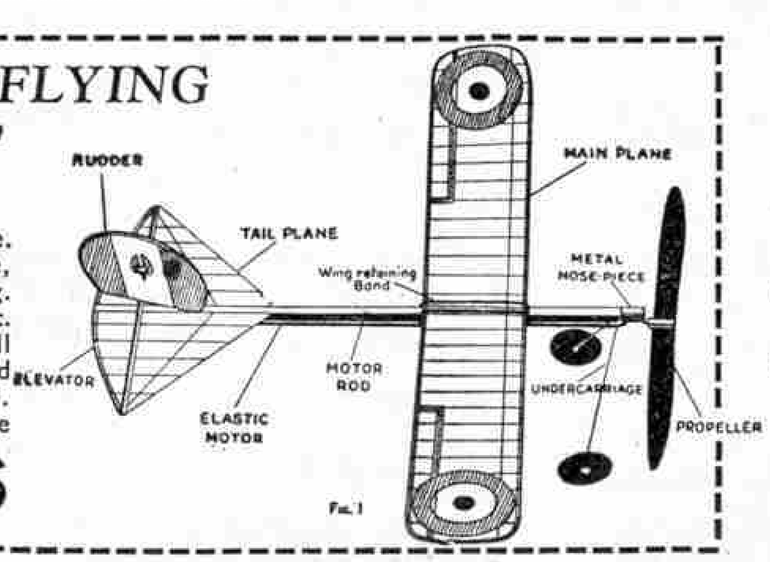
Post 9d. extra on all cricket bats.

Designed for INDOOR FLYING

The New "TADPOLE" MONOPLANE

We are the first store to feature this aeroplane. It weighs barely the 20th part of an ounce, and will do stunts as well as straight flying. It will loop the loop, roll, fly slowly, etc. Correctly handled the "Tadpole" will remain in the air for 40 or 50 seconds. Supplied in special box, with winder wheel attached. Designed primarily for indoor flying, the "Tadpole" will also fly outdoors on a very calm day.

Price complete, only **2/6** Post 6d.



GAMAGES, HOLBORN, LONDON, E.C.1

Telephone: Holborn 8484

A SKYSCRAPER WANTED

"How much are rooms in this hotel?"

"Ten shillings on the first floor, eight on the second, seven on the third and six on the fourth."

"Sorry, but the building is not high enough for me."

* * * *

"Ah could do two miles a minute in dat car 'cepting fo' one thing."

"What's dat, man?"

"De distance am too long fo' the shortness ob de time."

* * * *

Two children were arguing.

Willie: "It is."

Mary: "It isn't."

Willie: "I tell you it is, 'cos mother says it is, and if mother says it is, it is, even if it isn't."

* * * *

Client: "I want you to draw up my will, but I'm not sure how to dictate it."

Lawyer: "Just leave everything to me."

Client: "I suppose that would save time. It's bound to come to that in the long run."

* * * *

Inspector (to small boy): "Now, what are raised in damp climates?"

Small Boy: "Umbrellas, sir."

* * * *

"Well, did you find any eggs in the hen roost?"

"No; there was only the one that the hens use as a pattern."

* * * *

Henry from town, visiting his uncle's farm for the first time, saw a pitchfork in the stable.

"I say, Uncle," he said, "is that what the horses eat their hay with?"

* * * *

"Are you laughing at me?" demanded the professor, sternly.

"Oh, no, sir!" came the reply.

"Then," asked the professor, even more grimly, "what else is there in the room to laugh at?"

* * * *

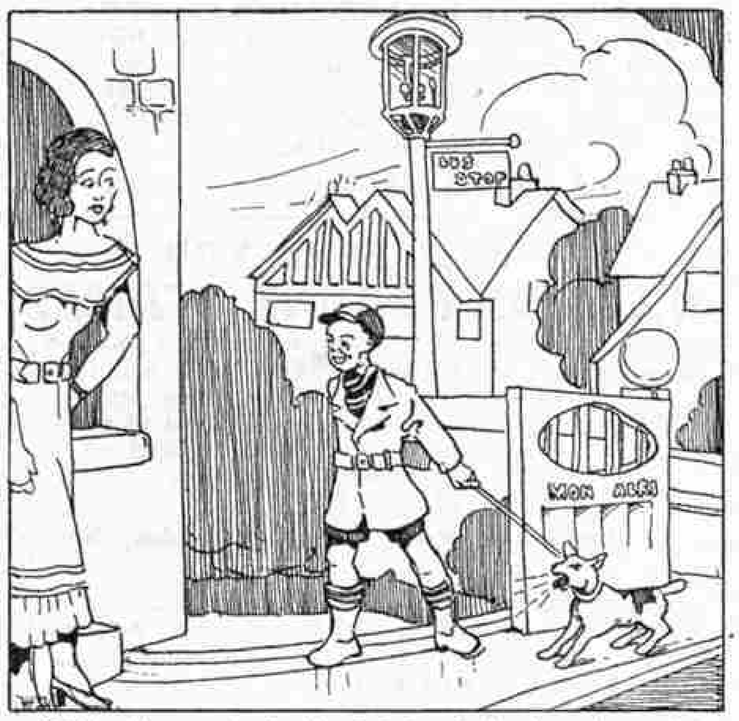
"What be the Squire now, Jarge?"

"'E be O.B.E., 'e be."

"Oh, be 'e?"

* * * *

PERSUASIVE ARGUMENT



Little Henry had pleaded hard to be allowed to keep a dog, but his mother was adamant. One day she saw him coming up the garden path pulling a small dog along by the end of a rope, the dog resisting and barking furiously.

"Mother," he said, "do let me keep this little dog. It's followed me all the way home."

* * * *

Golfer: "Hi, caddie, isn't Major Pepper out of that bunker yet? How many strokes has he had?"

Caddie: "Sixteen, sir. Fifteen ordinary, and one apoplectic!"

'SPECTS SO!

"Mummie, is it bay rum in the bottle on your dressing table?"

"No, dear, it's gum."

"H'm! I 'spects that's why I can't get my hat off."

* * * *

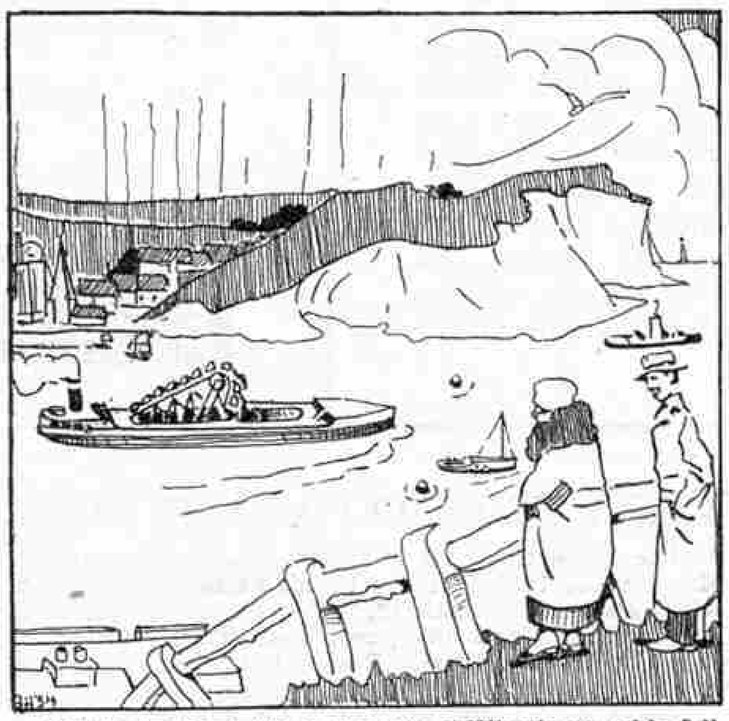
"I've saved up enough money to live at the rate of a thousand a year."

"Have you?"

"Yes, for about three weeks!"

* * * *

WET WORK



Old Lady (from the country): "What's yon ship?"

Host: "That is a dredger."

Old Lady: "The men down below filling the buckets ought to get good pay."

* * * *

The country policeman had held up the car.

"What's the matter," asked the driver.

"Where's your licence?" demanded the policeman.

"I've got it in my overcoat pocket, in the back of the car," replied the motorist.

"That's all right then," said the policeman. "If ye've got it I don't need to look at it. But if you didn't have one I'd have to see it."

* * * *

"What is troubling you, grandfather?"

"I've lost my glasses, my boy, and I can't see to look for them until I've found them."

THIS MONTH'S RIDDLES

"What Meccano part does a sheep have at shearing time?"

"A spring clip."

* * * *

"What Meccano part goes on for ever?"

"Boiler without Ends."

* * * *

"What Meccano parts are doing absurd acts of charity?"

"Parts No. 149, because they are 'Collecting Shoes for electric locomotives.'"

"Billy, give us a sweet?"

"No I shan't 'cos you asked."

"I didn't ask, did I, Billy?"

"No 'cos you don't want one."

* * * *

Citizen: "So you've been visiting our new college! Isn't it splendid? Tell me, what was the first thing that struck you on entering?"

Visitor: "A pea from a pea shooter!"

* * * *

"Would you like some bread and butter, Henry?"

"No."

"No what."

"You shouldn't say 'What' auntie; you should say 'I beg your pardon!'"

A GENTLE HINT

"Mummy, we're going to play animals at the zoo, and we want you to come and help us."

"What on earth can I do?"

"You can be the lady who gives them peanuts and buns."

* * * *

Town-dweller (seeing his first windmill): "Say, Uncle, that's some electric fan you have out there cooling the cows."

* * * *

"Five can go into one, you know."

"Don't be silly. Of course it can't!"

"But I tell you it can!"

"How?"

"Well, my five toes can go into one sock!"

* * * *

"Can I help you in any way?" the courteous motorist asked the lady who was standing beside her roadster with a worried look on her face.

"It's the petrol indicator," she replied. "It's past the halfway mark and for the life of me I can't remember whether it means that the tank is half full or that it is half empty."

* * * *

Old George of the antique shop was nothing if not a pessimist.

"Well, George," remarked a friend, "how's business?"

"Terrible!" was the reply. "If things are expensive people can't afford them, and if they aren't expensive they don't want them."

* * * *

Rastus was struggling with a pair of new boots.

"Phew!" he gasped. "Strikes me Ah shall neber get these boots on at all until Ah've worn dem a day or two."

* * * *

A negro was charged with theft and his lawyer decided to put him in the witness box.

"Sam, if you tell a lie, you know what will happen, I suppose?" said the Judge to the negro.

"Yes, suh," replied Sam, "I won't go to heaven when I die!"

"Quite right," declared the Judge. "And you know what will happen if you tell the truth?"

"Yes, suh," said Sam. "We lose de case!"

* * * *

THEY KNEW BETTER

Golfer (despairingly): "Surely, there can't be any worse players than me!"

Caddie: "Yes, there are, sir, but they don't play."

* * * *

"Are you complaining about the college pudding, sir?" asked the restaurant manager.

"Yes, there's something in it that ought to be expelled."

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10	„	5d.	20	Spain	2d.
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10	„	4d.	3	„ Catacomb	3d.
5	Porta Rica	3d.	20	Sweden	2d.
5	Philippine	2d.	50	„	1/–
10	„	4d.	20	Switzerland	2d.
5	Persia	2d.	50	„	1/–
10	„	4d.	5	Siam	2d.
20	Poland	2d.	10	„	4d.
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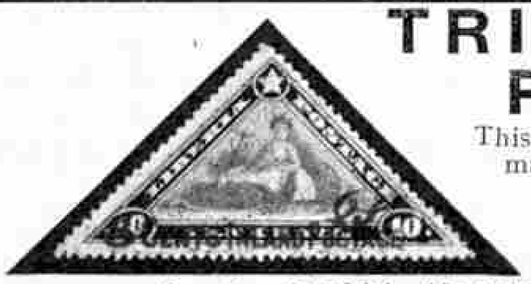

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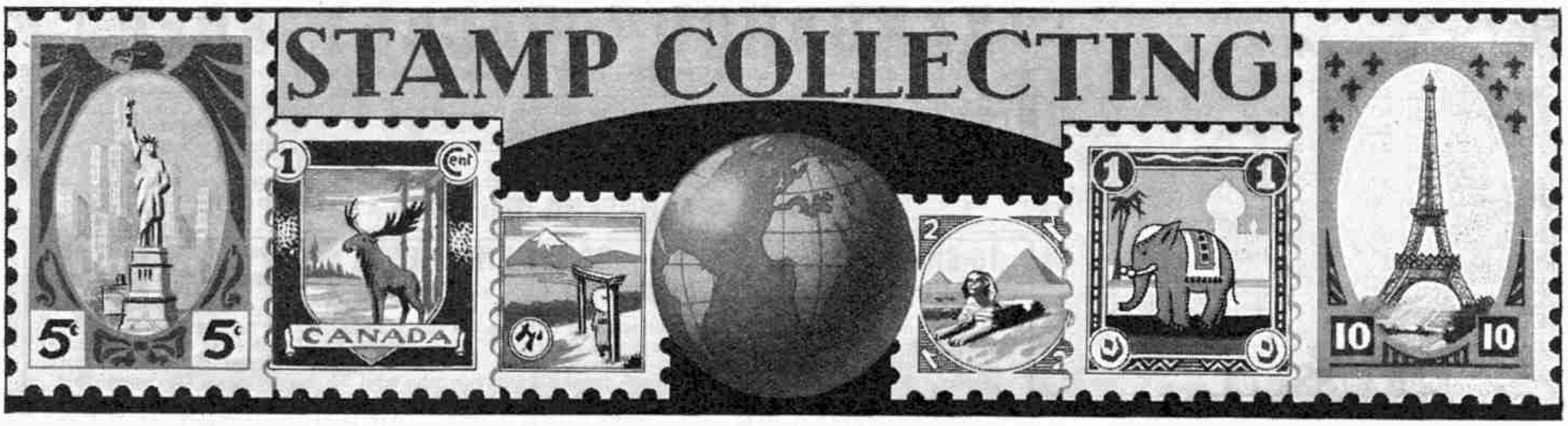

ERRORS AND VARIETIES

In our article last month we dealt with the methods of printing stamps and showed briefly how certain forms of what are known to stamp collectors as "errors" and "varieties" arise. In this article we propose to deal more closely with the topic because, although the study of varieties is one of the most fascinating sides of stamp collecting, it is one of the most difficult. It calls for the exercise of considerable commonsense to prevent the collection from developing into a hotch-potch of freakish bits and pieces that have little real interest for the collector and none at all for his friends.

Errors may arise in one or more of several different ways—in the designing, die-making, printing, the paper, the printing ink or the perforation; and it is a little difficult to lay down hard-and-fast rules that shall determine the importance of any particular error. The single item produced by the accidental folding over of a piece of paper, so that the sheet when opened out leaves one or more stamps only partially printed, is of no interest except as a curiosity, even though it may have been issued accidentally and used. On the other hand, the presence or absence of a simple line, undetectable by the unobservant person, may proclaim a stamp of first importance.

The Jamaica Union Jack "error" to which we refer in the accompanying article.

In last month's article we showed how alterations to a printing plate or die would create plate varieties, "re-entries," for example; and we referred also to the creation of *tête bêche* errors by the inversion of a stereo or cliche in relation to the remainder of the set comprising the printing plate.

In some circumstances *tête bêche* varieties are created deliberately, as when sheets of stamps are printed for use in booklets. To allow for subsequent folding, it is necessary to print certain sheets in two halves, one inverted in relation to the other. If such sheets should be placed on sale in the ordinary way, each one would provide several *tête bêche* pairs. Examples of this type are not infrequent, and an Indian reader recently advertised in the *"M.M."* a quantity of *tête bêche* blocks of the current 1a Indian stamp produced in this way. Their importance is considerably less than that of the error arising from the accidental inversion of a stereo.

The "inverted centre" variety produced by the inversion of a part of a stamp—the frame or the centre—in relation to the rest, is of even greater interest. Indeed, the greatest rarity among air stamps is the 24c. U.S.A. blue stamp with inverted centre issued in 1918. This error may be created in the same way as the *tête bêche* variety, but more usually by the accidental inversion of a sheet of paper in the printing.

Very frequently—always when more than one colour is employed—the printing of a stamp involves passing the paper through the press two or more times. If the sheet is fed into the press the wrong way round on one of these occasions, one part of the design will be printed upside down.

A quite common error that is found among stamps printed in two or more colours arises from faulty registration, that is, misplacing of the sheet when it is being fed into the press after the first impression. The result is that the later impression overlaps part of the first. The Greek 50 Dr. stamp reproduced on the next page illustrates this point. Careful examination will show that the centre is printed nearly $\frac{1}{16}$ in. too far to the left.

This is not an important error in itself—most collectors ignore it—but in one case, at least, it is eagerly sought. In the Rhodesian issue bearing a portrait of the King in Admiral's uniform, the centre of the stamp was printed in a different colour from the frame. In several sheets the registration of the two portions was poor, and a number of these were issued with the gap filled in by hand painting. Even these stamps are not catalogued, but are regarded more in the nature of curiosities.

These are but some of the mistakes that may occur in passing the paper through the press. There are others of prime importance. For example, if inadvertently the paper is put through twice for the same impression, the design will be printed twice, and the greater the distance between the two impressions the keener are collectors to secure specimens. Again, a sheet may be fed into the press the first time face upward and the second time face downward, with the result that a true impression, either of the whole or part of the stamp design, appears on both sides. This error must not be confused with what is known as the "offset" or "reversed" impression, that arises commonly from the piling of printed sheets one on top of the other while they are still wet. These are of no philatelic importance.

A tête bêche pair from South Africa's 1913/21 issue.

Many interesting errors are to be found among "overprints" and "surcharges." These are printed on the face of the stamp to alter its purpose or value in an emergency, and since such alterations may have been carried out hurriedly the liability to error is much greater than in the printing of the stamps proper.

As a rule ordinary type is used to print in the alteration, and wrong or inverted or missing letters, or completely inverted settings of the whole overprint, may be observed. Many interesting examples of errors of this type are to be found among the early issues of the Irish Free State. Inverted overprints, missing characters, and characters inserted by hand were discovered freely, and most of these errors are now commanding big values in the stamp world.

The minute differences noted in the two enlarged illustrations of similar sections of G.B. 1½d. stamps shown on this page, indicate that two different dies were used in preparing the printing plates.

So far we have been concerned with errors arising from the printing process or the immediately preceding preliminaries, but important errors may be created long before the printing plate is made. The artist may err badly in some detail of his design, for example, and if his mistake is not discovered until after the first issue of stamps has been made, its subsequent correction will create an extremely interesting "error." One example of an error of this type, priced within the range of the pocket of any young collector, is the 2½d. stamp of Jamaica's 1919 issue, an illustration of which appears here. The Union Jack in *(Continued on page 339)*

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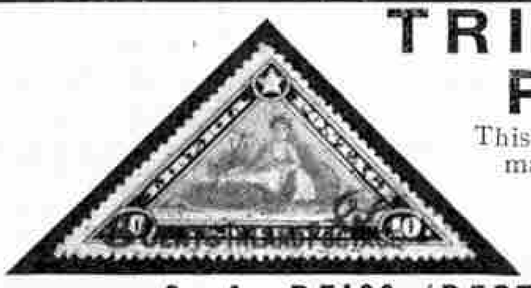

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A9, 11 Antioquia 1899 (cat. 2/3), 4d.; D1, 6 Dutch Indies, 2½d.; D3, 3 Dominica, 2d.; F1, 6 Fr. Indo-China, 1907-22, 2½d.; F2, 6 Fr. Indo-China, 1927-31, 2½d.; G1, 7 Greece, 1927, 3d.; G5, 3 Greece, 1927-8 Comm., 3d.; H4, 3 Holland, 1913, 3½d.; I10, 12 Italy, Rome Founding, 4d.; P18, 21 Persia, 1911, 1/–; T3, 5 Thessaly, Octagonal, 6d. Postage extra.

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RICHMAN TRADING CO., Room G, 29, Venner Road, London, S.E.26.

Stamp Collecting—(*Continued from page 337*)

the left-hand panel is shown as though hoisted upside down, an error that was corrected in 1921.

Not all artist's errors are corrected, however. The St. Kitts-Nevis stamps issued in 1903 showing Christopher Columbus holding a telescope to his eye is a case in point. The telescope was not invented until many years after Columbus' death, but no attempt was made to remove the anachronism by altering the design. Indeed in 1920 the design was repeated in a composite design showing also the King's head. This artist's mistake cannot be termed a stamp "error," therefore, because all stamps in the series are alike.

As we said at the outset of this article, errors may arise in directions quite apart from the design and its printing, and we will take an early opportunity of dealing with those that may occur in the use of the wrong ink or paper or in the perforation, points that are just as interesting as those that we have covered in this article.

In the meantime we urge our younger readers not to trouble about varieties as a pursuit in the first stages of their collecting. Later they will find it impossible to ignore them, but in the early years they will gather experience that will stand them in good stead when ultimately the urge to specialise makes itself felt.

"The Stamp's The Thing!"

With the words of our headline as their slogan, the publishing staff of Stanley Gibbons Ltd., have been working for two years on the "Simplified Stamp Catalogue" to which we referred in our February issue.

The advance notes promised a catalogue that would meet the demand for a really simple catalogue at a low price, and the promise has been admirably fulfilled. Only stamps possessing major differences in design, value or colour have been included, watermarks and perforations are ignored; but even so, more than 51,500 stamps are listed, over 6,300 of them being illustrated with blocks of the actual size of the stamps themselves.

The general arrangement of the catalogue lists all countries in alphabetical order, the name of the country being followed by abbreviations indicating the Continent in which it is situated and—where necessary—the Empire to which it belongs. These notes are followed by brief explanatory details of the geographical position and the currency of the countries.

The lists of stamps are so up to date that in some cases are included issues that appeared as recently as February last. The pricing is based on the "big" Gibbons' catalogue, of course, but in each case the figure is for the commonest variety covered by the "Simplified" catalogue.

The catalogue itself is printed in very clear type on surfaced paper that provides splendid reproductions of the illustrations, and the whole makes up into an attractive and exceedingly compact volume of 972 pages. It will make a very strong appeal to every young stamp collector. The catalogue may be obtained from any stamp dealer, price 5/–, or direct from Stanley Gibbons Ltd., 391, Strand, London, W.C.2, at 5/9 post paid (Overseas 6/1 post paid).

Stamp Gossip
and Notes on New Issues

An Interesting Contrast

Many strikingly interesting designs have been used for the stamps of Italy's African Colonies in recent years, and we reproduce here the 10c. stamp from Eritrea's new issue. The camel, "Ship of the desert" from dim history up to modern times, strikes an interesting contrast with the aeroplane, the future ship of the desert, typified by the Dornier DoX, illustrated here on the 13m. value of Egypt's recent Aeronautical Congress issue to which we referred in our last issue.

New Issue for Sarawak

Next month Sarawak is to issue an entirely new series of stamps. There will be a full range of 20 values from 1c. to $10 and each will bear the same design, a portrait of the Rajah of Sarawak, Sir Charles Vyner Brooke. The portrait will be flanked on each side by carvings of bamboo.

Irish Christmas "Charities"?

The "*Irish Press*," an Irish daily paper, recently devoted editorial space to advancing the case for the issue of charity stamps at Christmas time. As this paper is a Government organ that carries great weight in official circles, there would seem to be a distinct possibility that the Irish Free State will issue Christmas charity stamps this year.

Indian Air Mail Stamps

When present stocks are exhausted, the Indian air mail issues will be discontinued, and subsequently ordinary postage stamps only will be available for franking air mail correspondence.

* * *

The new Greek high values made their appearance recently and, as our illustration of the 50 Dr. value shows, they are really beautiful specimens of engraving and printing skill. The dies and plates were prepared by Messrs. De La Rue and Company, of London, and the printers were the Aspiotis-Elka Company, of Corfu.

The 50 Dr. value shows a view of the Greek cruiser "*Averoff*" and, inset, a portrait of Admiral Kondouriotis. The 100 Dr. takes us back to the mythology of ancient Greece, with a beautiful bust of Hermes.

Hayti's New Issues

The most interesting of this month's new issues is the full set of ordinary post stamps from Hayti, its first new general issue for nearly 10 years. There are seven values ranging from 3c. to 2g50, with designs largely devoted to commemorating the life and work of Henri Christophe, one of the three leaders in the country's struggle for independence in the early years of the 19th century.

Christophe was a full-blooded African negro who in 1806 became "provisional leader of the Nation." Political differences with other rivals for power led him to retire to the North of Hayti, where he founded the new "State of Hayti." His principal opponent, Pétion, appointed himself President of the Southern "Republic of Hayti." Later Christophe proclaimed himself "King" of his territory, and it was during his reign that there were built the great Castle "Sans Souci" and the Citadelle, that are illustrated in the stamp series.

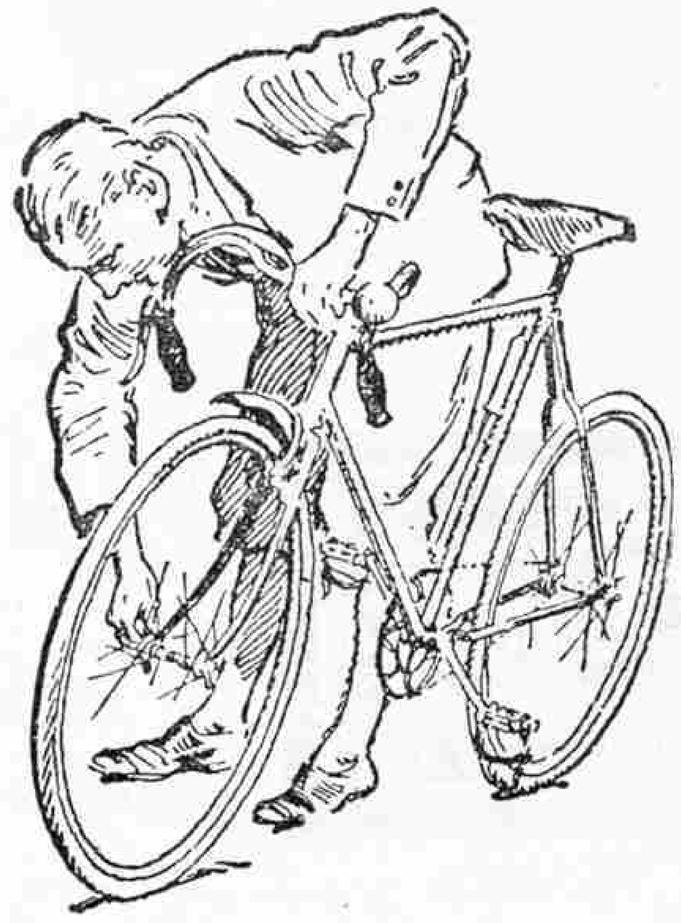
Sans Souci, now in ruins, was a magnificent castle, intended at the time of building to equal in size and grandeur any castle in Europe. It is excellently shown on the 25c. value. An aerial view of the Citadelle is shown on the two air stamps that are complementary to the series. As our illustration shows,

it was built in a dominating position among the mountains, the actual location being at the summit of the Bonnet-a-l'Eveque, 2,600 ft. above sea level. It was built regardless of cost and, it is said, at the expense of the lives of many thousands of labourers. Its enormous size may best be gauged from the fact that the main gun corridor, the Galerie du Roi, shown on the 1g stamp illustrated here, was 300 ft. in length. The Citadel was never occupied, for shortly after its completion the State of Hayti was re-absorbed into the southern Republic.

The remaining designs are as follows: 3c., President Vincent; 5c., Aqueduc de Prince; 10c., Fort National; 50c., Chapelle de Christophe, Milot; 62½c., Batterie de Vallieres.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

The "engine room" of your cycle



You know how sometimes people get a name for doing a job well. That's just why the Renold and Coventry Chain Company are known all over the world for power transmission. They installed the biggest chain drive in Europe (1,200 horse power) and they have equipped the "engine room" of millions of cycles with the world-famous Renold Cycle Chain. Look for the name "Renold" stamped on the links when you buy a new cycle chain.

RENOLD CYCLE CHAIN

A POSTCARD WILL BRING YOU A COMPLETE VEST-POCKET SIZE ROAD MAP OF THE BRITISH ISLES . . . . . **FREE**

Don't miss this useful gift

THE RENOLD AND COVENTRY CHAIN CO. LTD., DEPT. L3, DIDSBURY, MANCHESTER

Pets of an African Camp—(*Cont. from page 287*)

he sat down near the camp stove, serious and quiet; when it was hot he climbed up on the roof of the tent. In any case, within five minutes he succeeded in getting himself into such a complicated tangle with his rope and every available pole and peg that he would be half strangled. Then he grew crazy, and began a monotonous lamentation, interrupted only by shrill fits of scolding, until someone came to free him, when he at once began his show all over again.

Tikky was always ready for caresses. As soon as one of us came near him he would lift an arm voluptuously, half closing his eyes and dropping his head on his shoulder with the sentimental air of a cinema actress. He wanted to be scratched and stroked, and one suffered from a fond delusion if he thought the little baboon would ever tire of such attentions.

When Tikky eats he is voracious, gluttonous, insatiable. One can see his tiny blue "tummy" inflating and inflating until the skin becomes stretched like a tom-tom. Then he sits down with the face of a melancholy Buddha, and continues with a very resigned manner until he has completely filled the two pouches at the sides of his mouth. These pouches are his store. Some hours later, when the appetite has returned and the "tummy" has deflated, he gives a good punch with his fist to a pouch, pushing its contents into his mouth and enjoying a little lunch!

In the evening I put him to sleep in the verandah of my tent in a box, for I am afraid that a leopard or hyena might otherwise carry him off, and he knows that when I put him in the box he must stay there and not move. Some nights he is not at all sleepy. Then, as soon as I go away for a few minutes, he jumps out, accomplishes in the smallest number of minutes the largest number of mischiefs possible to imagine, and when he hears my returning footsteps jumps back into the box. There he assumes the most angelic slumber, his eyes peacefully closed.

As compensation, in the morning he is very good in order not to awaken me. But as soon as he hears me make some noise he is out of his box, and prances in to tell me good morning with all conceivable caperings. His dearest delight is to sit down on the pillow near my head and try to find in my hair some alien inhabitants. Unfortunately he is doomed to disappointment, and probably in that moment he considers me far from respectable. So many hairs, and not even one inhabitant? And he goes away with the most disillusioned expression.

Poor little Tikky, he was so desperate when we had to leave him. We, too, felt sad to part with the delightful little creature, but we consoled ourselves with the thought that he would not be happy in the cold and fogs of London, and that he would soon grow to love the very kind friend to whom we entrusted him.

Story of Artificial Silk—(*Cont. from page 299*)

the spinning spindle. The first coils are formed nearest the metal, each succeeding layer being added within the other, and cross wound, so as to form a compact cake or cheese. When this is made the box is lifted off the spindle and its contents are emptied, a spare box being at hand for immediate replacement in order that the spinning may not be interrupted.

For those who read in the first of these articles the story of Nature's method of producing real silk it will be easy to recognise in the cake or cheese of rayon a scientific approximation to the cocoon. In the spinning box they may see an imitation of the spinning "hut" constructed by the silkworm, in which the successive layers of thread are spun by crossing and re-crossing each layer in a constantly decreasing diameter, thus emulating the dense and ever contracting mass of figure-eight coils designed by Nature to conceal one of her creatures during a period of transformation. It may be pointed out, however, that while in the cocoon of natural silk a great proportion of the four days' laborious spinning has to be used up in the form of silk waste, there is no such variation in quality from first to last in the cake or cheese of rayon which, according to its degree of fineness, is completed in one or two hours in this triumph of scientific imitation.

When the cheese of rayon is completed the glass funnel is lifted clear of the spinning box, and the contents are removed and kept in a moist atmosphere until they can be passed on to the next process, that of reeling the cheeses into hanks. In this process the cheeses are placed on small projections and the ends of the threads led to the swifts, which are hexagonal frames of brass or wood adapted to be worked by hand or power, and which on being rotated form the threads into a hank. On the swifts adapted for power driving there is a stop motion consisting of a light metal pin, shaped like a hairpin, that rests on each individual thread. If a thread breaks, the pin falls between a star wheel arrangement that stops the machine. This permits the broken end to be found and pieced up, after which the swift may be re-started.

As reeled into hanks or skeins, the rayon is now in the loose form that permits of a thorough washing, drying and stretching. After the first of these operations the hanks, which have all been reeled on swifts of a standard size, are placed on stretching frames and subjected to tension, and it is in the drying and stretching that the rayon acquires its lustre.

The subsequent processes are those of bleaching, scouring, washing and soaping. These operations are carried out on an automatic system whereby the hanks are held on porcelain rollers mounted on a frame which, by means of an overhead runway, may be moved about from point to point, and its contents lowered at will for each operation until, finally dried, they are delivered at the testing room. There the hanks of rayon are examined and graded according to their freedom from faults.

For certain manufacturing purposes the graded filaments may have to undergo further processes before they reach the loom or the hosiery frame, but as these vary only slightly from the treatment given to other textiles, it is at this stage that the story of rayon production comes to an end.

Food From the Air—(*Continued from page 273*)

under the debris; and amid the heap of ruins that had been the factory was a crater 300 ft. across and 40 ft. deep. Fortunately no repetition of this catastrophe has taken place, even on a small scale, and I was assured at Oppau that the efficiency of the new plant made security unquestionable.

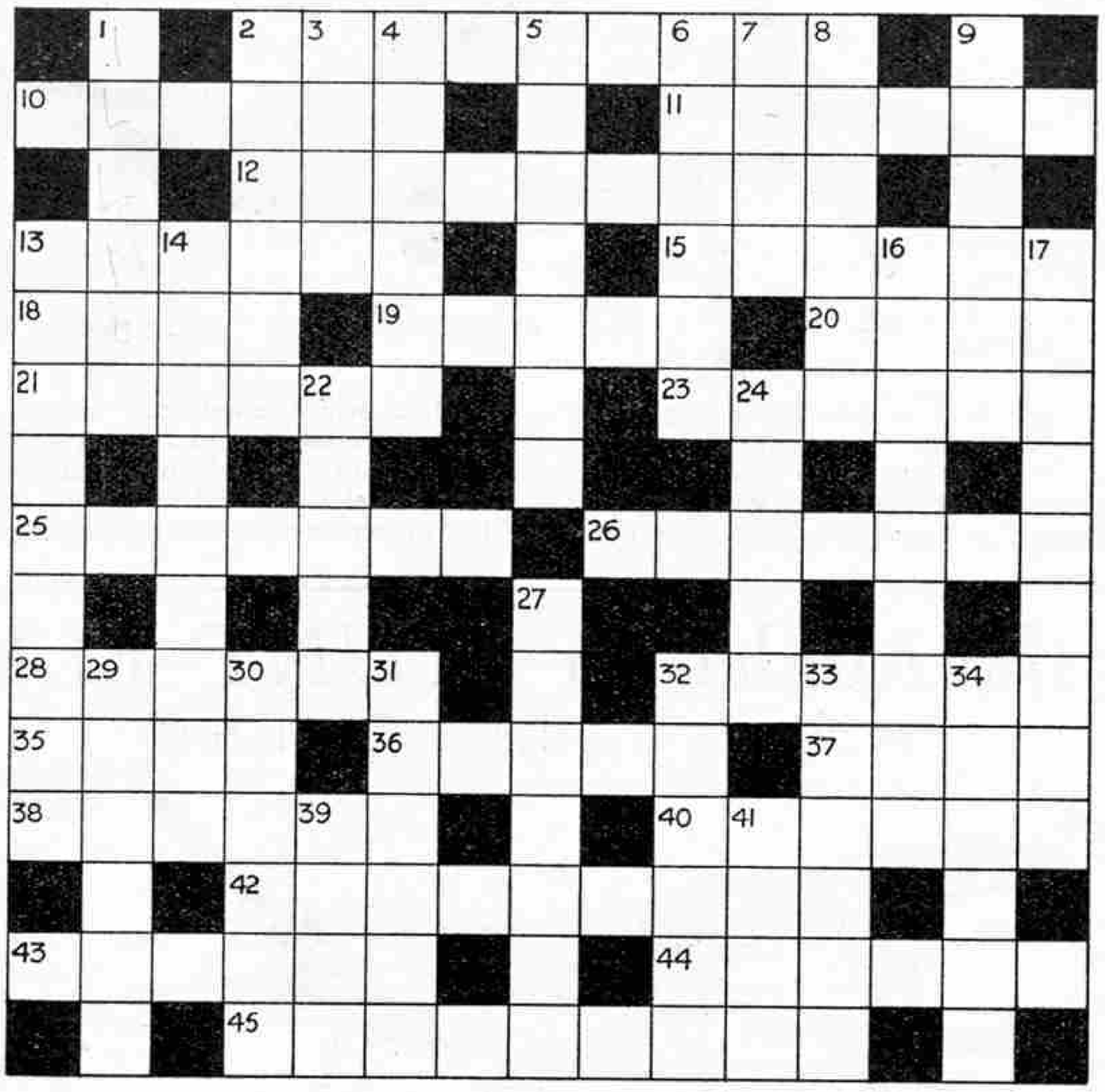
To the ammonia gas that has been prepared, water is added, and the liquor is stored in tanks with a capacity of 175,000 cu. ft. The last step in the process is to convert the carbonated ammonia liquor into ammonium sulphate, the fertiliser. This is done by means of gypsum, a mineral that is obtained from the company's own quarries and is there crushed and pulverised to a fine powder. The liquor and the gypsum are churned up in vats by mechanical stirrers. In the building where this takes place there is always an overpowering stench of strong ammonia, so that the eyes and nose of the casual visitor become liberally tearful. The smell sense of the workmen here has been petrified by long association. Besides creating this all-pervasive smell, the chemical action produces a deafening, prolonged "hiss," as if a thousand steam-engines were releasing their exhausts.

A thick sludge falls to the bottom of the vats, and is separated by canvas filters from the liquid; the latter contains the fertiliser, and is evaporated and centrifuged to extract it in solid form. Then it is conveyed by moving belts to the silos, the final awe-inspiring consummation of this great industrial enterprise.

In order to view the silo, or storage-pit, one takes a long upward journey by lift. Looking down from the narrow wooden platform at the top, one has the sensation of standing in the gallery of a colossal theatre. Five hundred feet away is the stage, a hundred feet below the vibrating planks is the floor. Twenty thousand people could stand here side by side in comfort; the "big" silo at Leuna could accommodate four times as many! Down there lies a ghastly white heap, almost insignificant in the gigantic bin, the powder that to-morrow will be scattered to wherever man tills the soil, to multiply his crops and repel the dread shadow of want. Air, soil, food—so the magic cycle goes on, impelled by the driving force of scientific research.

Competition Corner

APRIL CROSSWORD PUZZLE



CLUES DOWN

1. Sickness
2. Regret
3. Deserve
4. Settled
5. Sarcasm
6. Guard
7. True
8. Salty
9. Peaceful
13. Challenger
14. Gloomy
16. Shaking
17. Re-composes
22. Expulsion
24. Animal
27. Ward
29. Obtain
30. Trader
31. Legal Possession
32. Influence
33. Stirred
34. Ancient Tribe
39. Hemispherical Structure
41. Architectural fillet

CLUES ACROSS

2. Opposers
10. Notice
11. Secured
12. Methodical
13. Agree
15. Boy's name
18. Heraldic Fur
19. Mistake
20. Numeral
21. Tapped
23. Ancient Egypt
25. Out of sight
26. Different
28. Lives
32. Overhead
35. Nothing
36. Apart
37. Trickle
38. Steps
40. Springs
42. Idlers
43. Grave
44. Gripped
45. Select again

This month's crossword puzzle will be found to follow the lines of all the previous ones we have set on this page, in that it is for amusement only, and every effort has been made to avoid unfair traps in the form of alternative solutions. The clues will be found to be perfectly straightforward, and every word used can be found in Chambers' or any other good dictionary, with the exception of one or two proper nouns that are well known to all. The rules governing the solution of crossword puzzles are so well known, however, that it is unnecessary to give any further explanation of the requirements of the competition.

Prizes of Meccano or Hornby Train goods (to be chosen by the winners) to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the first four correct solutions, in the order in which they are opened on the morning following the closing date. In making the awards neatness and style of presentation will be taken into consideration. The prizes will be duplicated for the Overseas section, open to all readers living outside Great Britain, Ireland and the Channel Islands.

Entries should be addressed " April Crossword Puzzle, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to reach this office not later than 30th April. Overseas closing date, 31st July.

Competitors should not mutilate their magazines by cutting out the crossword illustration. Instead they should make a copy of the square on the same scale, or larger, and make use of that for the Contest.

The 1934 Photo Contests

This month we recommence our photographic contests for the spring and summer seasons, and following the great success of these contests in recent years it is intended again to allow competitors to select their own subjects. The prizes will be awarded to the best photographs submitted each month, irrespective of subject, size, make of camera, plate, film or paper. The only restrictions are that each print must bear a title and that the exposure must have been made by the competitor. The developing and printing may be professionally done.

The competition will be divided into two groups, Home, for those living in Great Britain, Ireland and the Channel Islands; and Overseas, for those living outside those areas. Each group will be divided into two sections, A for those aged 16 and over, B for those under 16; and prizes of Meccano products or Photographic Materials (to be chosen by the winners) to the value of 21/– and 10/6 will be awarded in each.

In addition to its title, each print must bear on its back the competitor's name, age and address. Unsuccessful entries will be returned if a stamped addressed cover is sent for the purpose. In the ordinary course prize-winning entries are retained, and it is a condition of entry that the Editor shall have the right to reproduce any entry without fee.

Entries sent this month must be addressed " April Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 30th April. Overseas closing date, 31st July.

COMPETITION RESULTS

HOME

Motor Contest.—1. R. C. Storrar (Letham Ladybank); 2. R. W. B. Brown (Carlisle); 3. N. H. Mangnall (Gosport); 4. I. H. Cassie (Aberdeen).

Figure Drawings.—1. C. Norris (Dursley); 2. D. N. Truss (Chipperfield); 3. D. Fosten (Battersea, S.W.11); 4. C. Spencer (Warsash).

January Stamp Voting.—1. L. Simpkins (Thornton Heath); 2. A. W. Stanbury (Hatherleigh); 3. R. Jeffery (Goudhurst); 4. A. Johnson (Wirksworth).

OVERSEAS

November Sketchograms.—First Prizes: Section A, Miss M. Morgan (Cremorne, N.S.W.); Section B, R. J. Dickison (Dunedin, N.Z.). Second Prizes: Section A, S. F. Desai (Bombay); Section B, J. E. Davis (Bahia Blanca, Argentina). Consolation Prizes: D. Allderman (Firgrove, C.P.); W. Sausmikat (Montreal); R. Lister (Red Deer, Alta.); J. Parminter (Wairoa, N.Z.).

Advertisement Bargain.—1. R. Garcia (Port-of-Spain); 2. H. Dekker (Capetown); 3. W. J. T. Watson (West Leichhardt, N.S.W.); 4. J. C. Carter (Capetown).

"FROG" Model Aircraft

Puss-Moth

A MAGNIFICENT FLYING SCALE MODEL AEROPLANE

PRICE **17'6** NET

Complete with spare motor, mechanical winder, lubricant and illustrated instruction manual.

BRITISH MADE BY
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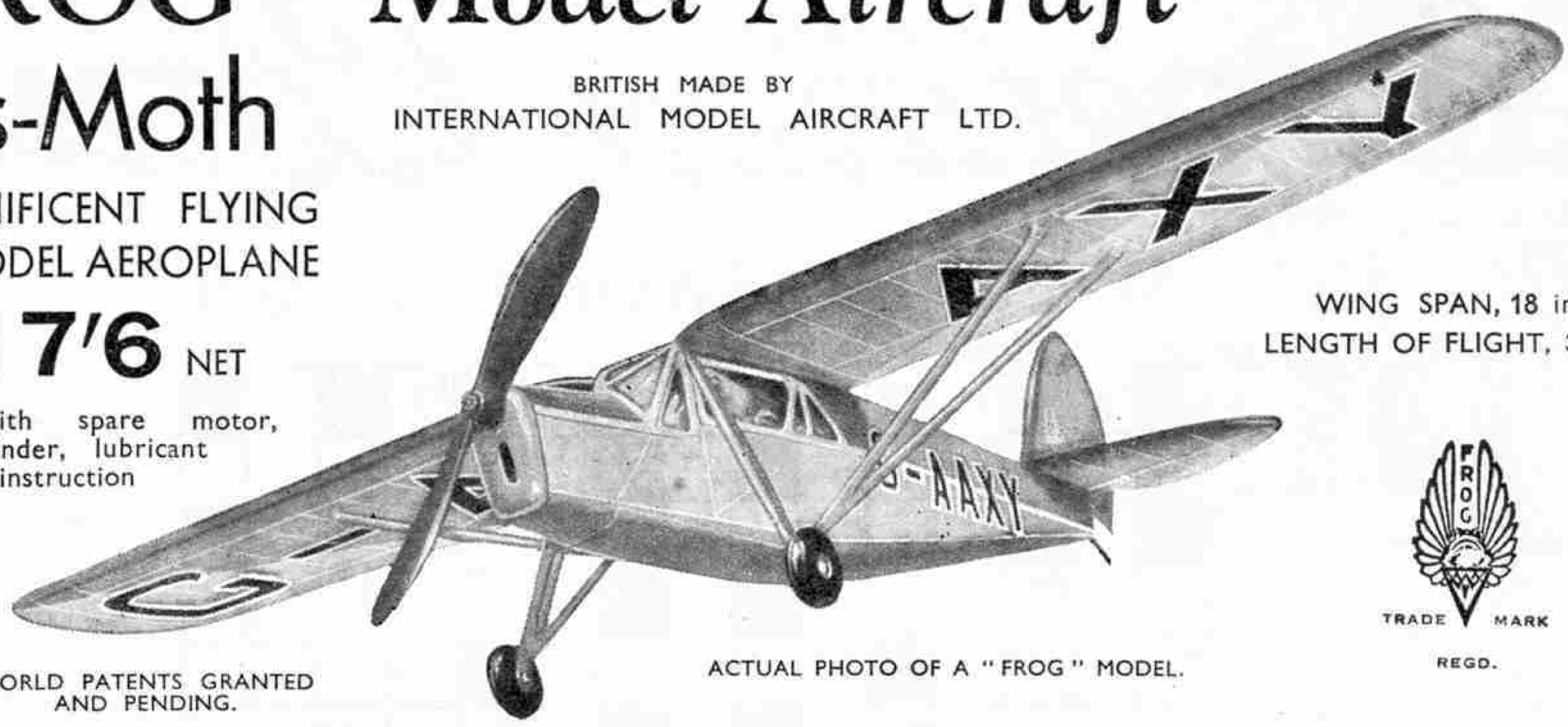


WING SPAN, 18 ins.
LENGTH OF FLIGHT, 300 ft.

WORLD PATENTS GRANTED AND PENDING.

ACTUAL PHOTO OF A "FROG" MODEL.

TRADE MARK REGD.

An attractive model of the famous record-breaking light aeroplane. Perfect in every detail. The all-metal fuselage has patented bulkhead construction which gives it great rigidity, and the cabin and roof lights are fitted with non-flam celluloid. The wings are also made by an entirely new method which eliminates warping. Two strong elastic motors are coupled to a dual gear-box. All main parts have the famous "Frog" patented quick detachable fittings. The model is finished in light blue, orange and black, and has an extremely handsome appearance.

This is the Model for STUNT FLYING!

"FROG" MK IV INTERCEPTOR FIGHTER

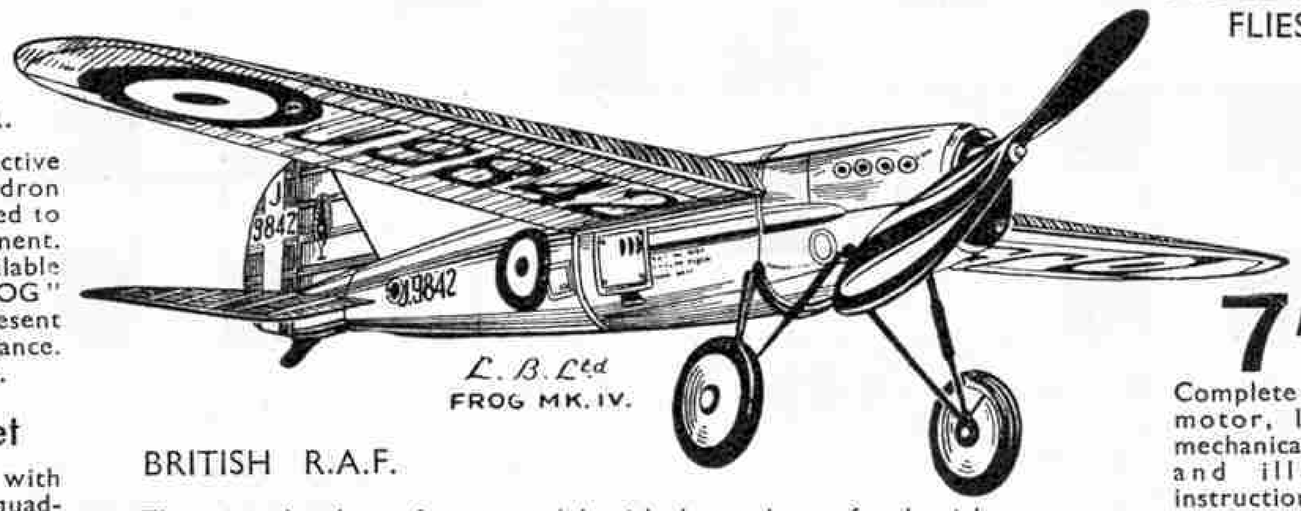
DECORATE YOUR "FROG" MK IV WITH R.A.F. SQUADRON MARKINGS IN COLOUR.

Make your model doubly attractive with these handsome squadron markings. They are easily applied to wings and fuselage and are permanent. There are six different sets available and each is in bright colours. "FROG" models treated in this manner present a handsome and unique appearance. Ask your dealer for details.

Price **1/6** per set

Complete models are available with the markings of any of the six squadrons already in position and with the airscrew and undercarriage coloured to match.

Price **10/6** complete



BRITISH R.A.F.

The original and now famous model, with the crash proof and quick detachable fittings. Learn to make it loop, barrel-roll, half-roll and do the many interesting stunts of which it is capable. Made in the full colours of seven nationalities: British R.A.F., Italy, France, U.S.A., Dutch, Argentine, Belgian.

WING SPAN, 11 ins.
FLIES 300 ft.

7'6

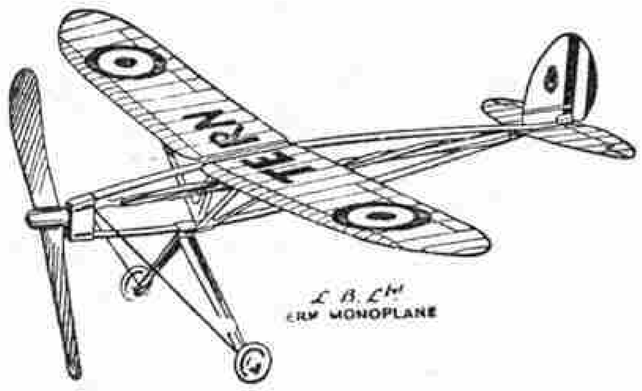
Complete with spare motor, lubricant, mechanical winder and illustrated instruction manual.

The mechanical winder enables all "FROG" Model Aircraft to be quickly wound for flight; this is an exclusive "FROG" feature.

JOIN THE "FROG" CLUB
All "FROG" owners are eligible for membership. Write for particulars.

THE SENSATION OF THE B.I.F. AT OLYMPIA

TERN MONOPLANE



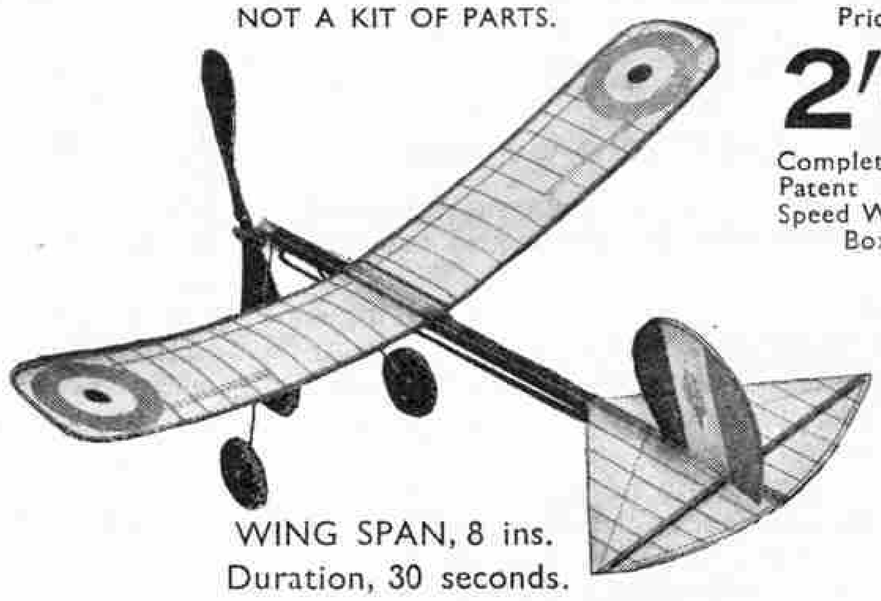
A splendid model for outdoor flying. Very durable construction. Wing Span 15 ins. Flies 200 ft.

1'6

TADPOLE INDOOR FLYING MONOPLANE

This is the amazing new model for indoor flying. It will rise off the floor or table or even off its own box, and fly round any room—large or small. Marvellous flights—no skill required—quickly wound with its patented High Speed Winder.

NOT A KIT OF PARTS.



Price **2'6**

Complete with Patent High Speed Winder Box.

WING SPAN, 8 ins.
Duration, 30 seconds.

"FROG" MODEL AIRCRAFT ARE SOLD AT ALL GOOD STORES AND TOYSHOPS

Sole Concessionaires:

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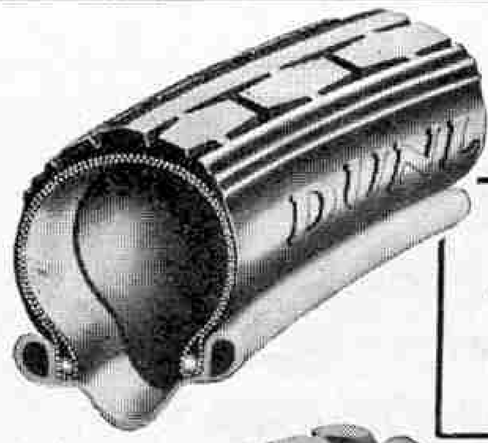
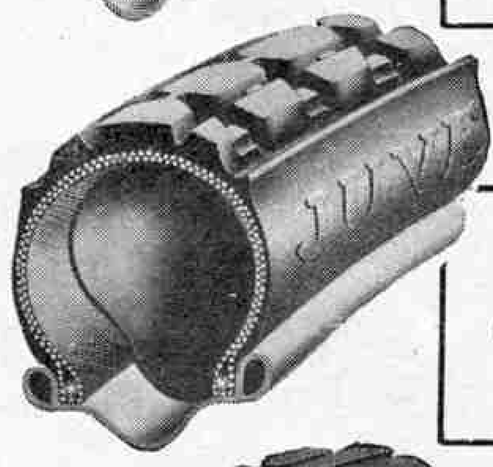
Boys!

These three cycle tyres have been specially designed and built for you. You cannot do better than fit



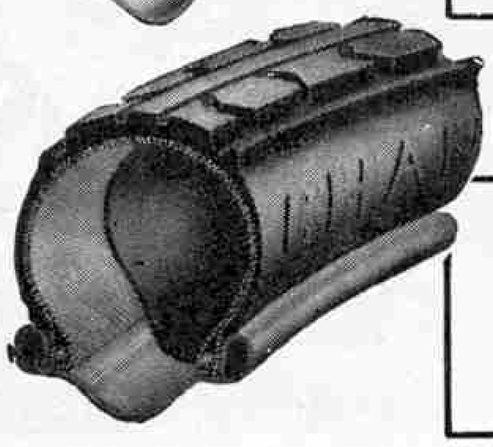
DUNLOP JUVENILE
COVER 5/6
TUBE 2/6



DUNLOP SPORTS JUVENILE
COVER 4/6
TUBE 2/3

DUNLOP

The Juvenile and the Champion Juvenile are for every-day cycling, for pottering and touring; and the Sports Juvenile is a really speedy tyre for fast road work.



DUNLOP CHAMPION JUVENILE
COVER 3/6
TUBE 1/9

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4H/316

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A little goes a long way

Why should you always use Seccotine? Just this: It is the strongest adhesive in the world. Tests have proved this. Actually, Seccotine is more than TWICE AS STRONG as other adhesives. That is proof, not guesswork.
But remember when you use Seccotine to apply it very sparingly. A very little is all that is necessary to get a perfect joint. Made by British workpeople.

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When light conditions are poor—Selochrome, with its higher speed, colour sensitivity and anti-halo backing, gives you the equivalent of a faster lens.

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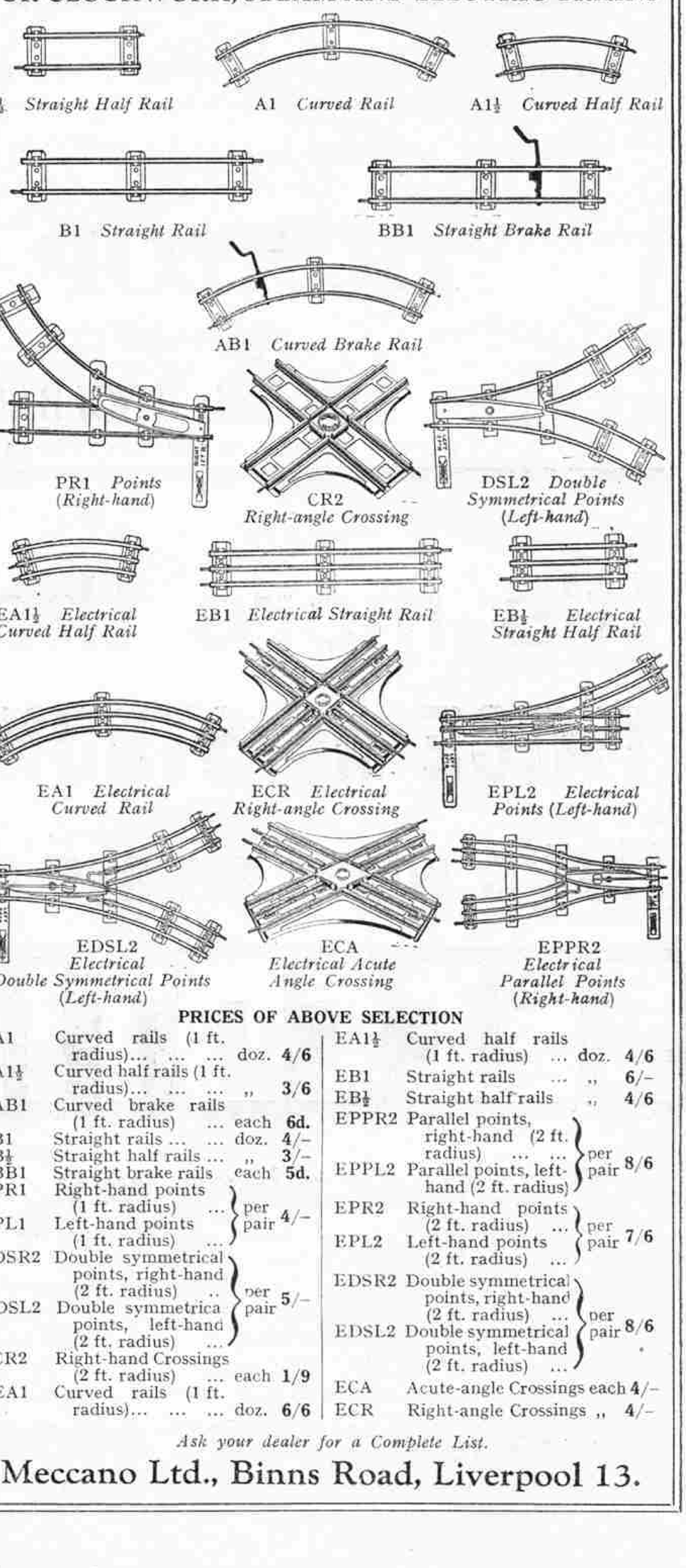

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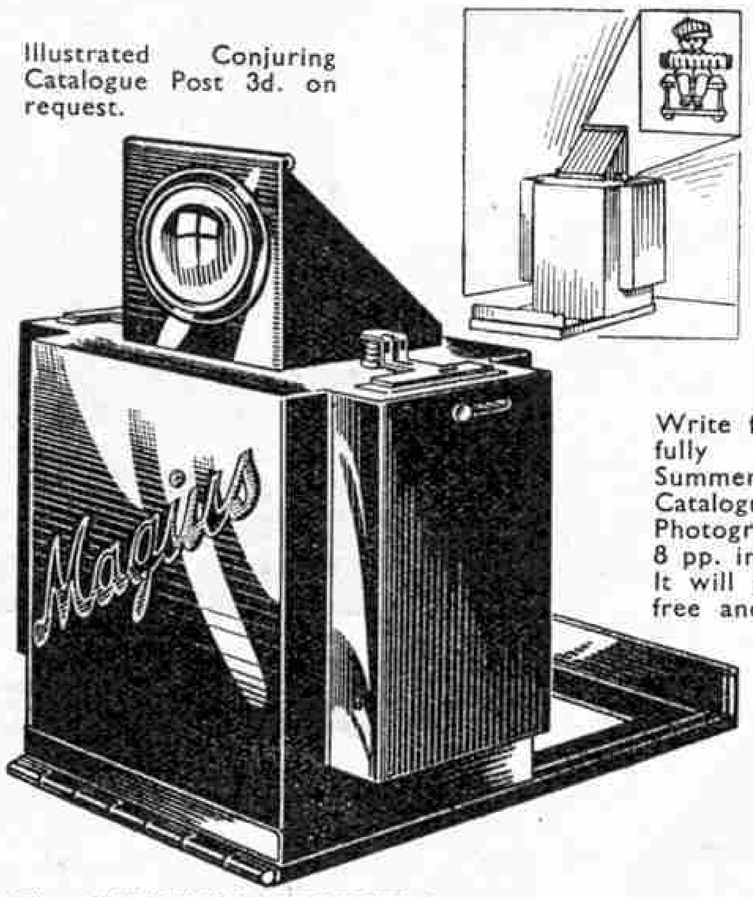

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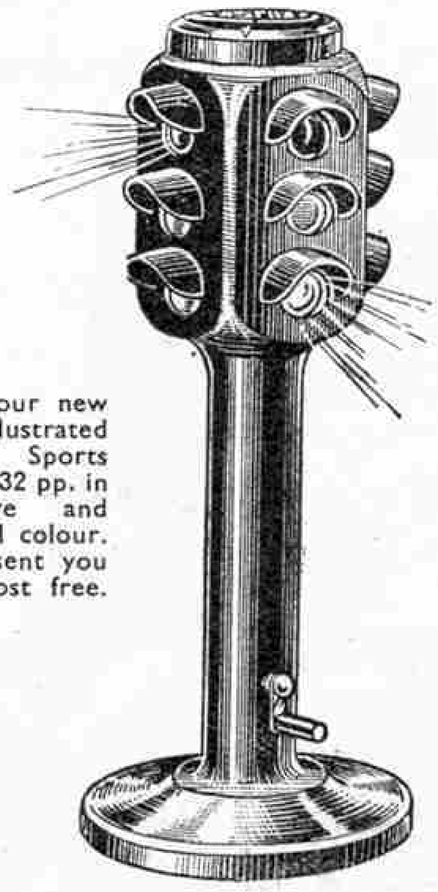

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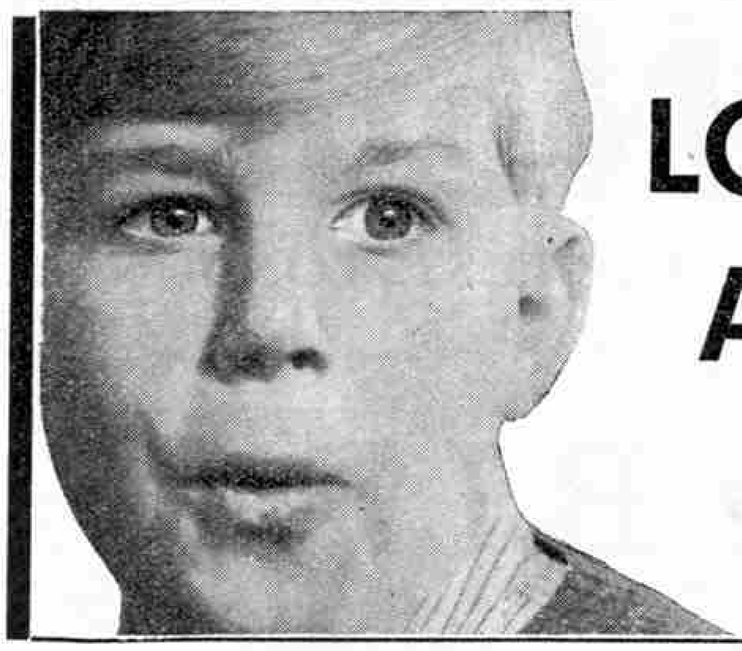

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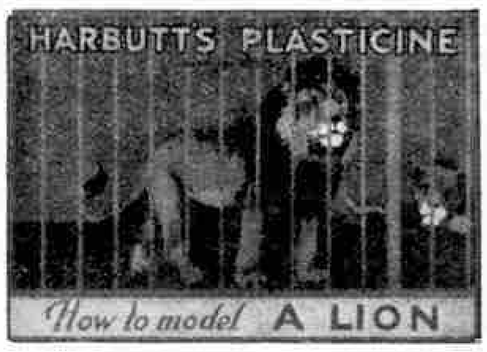

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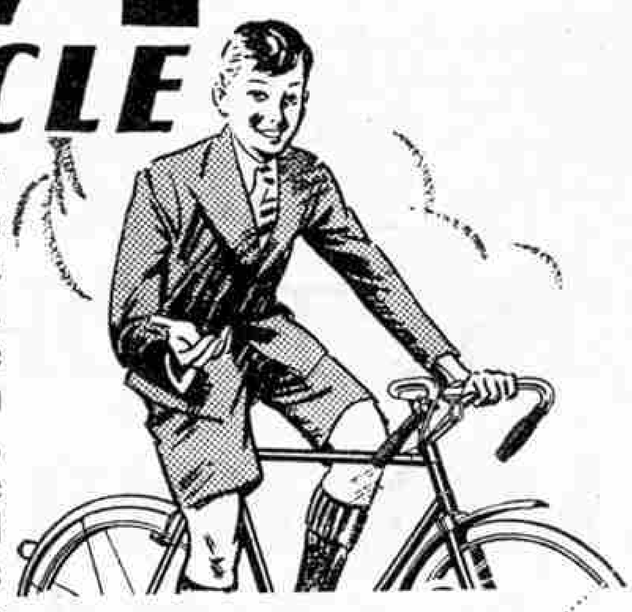

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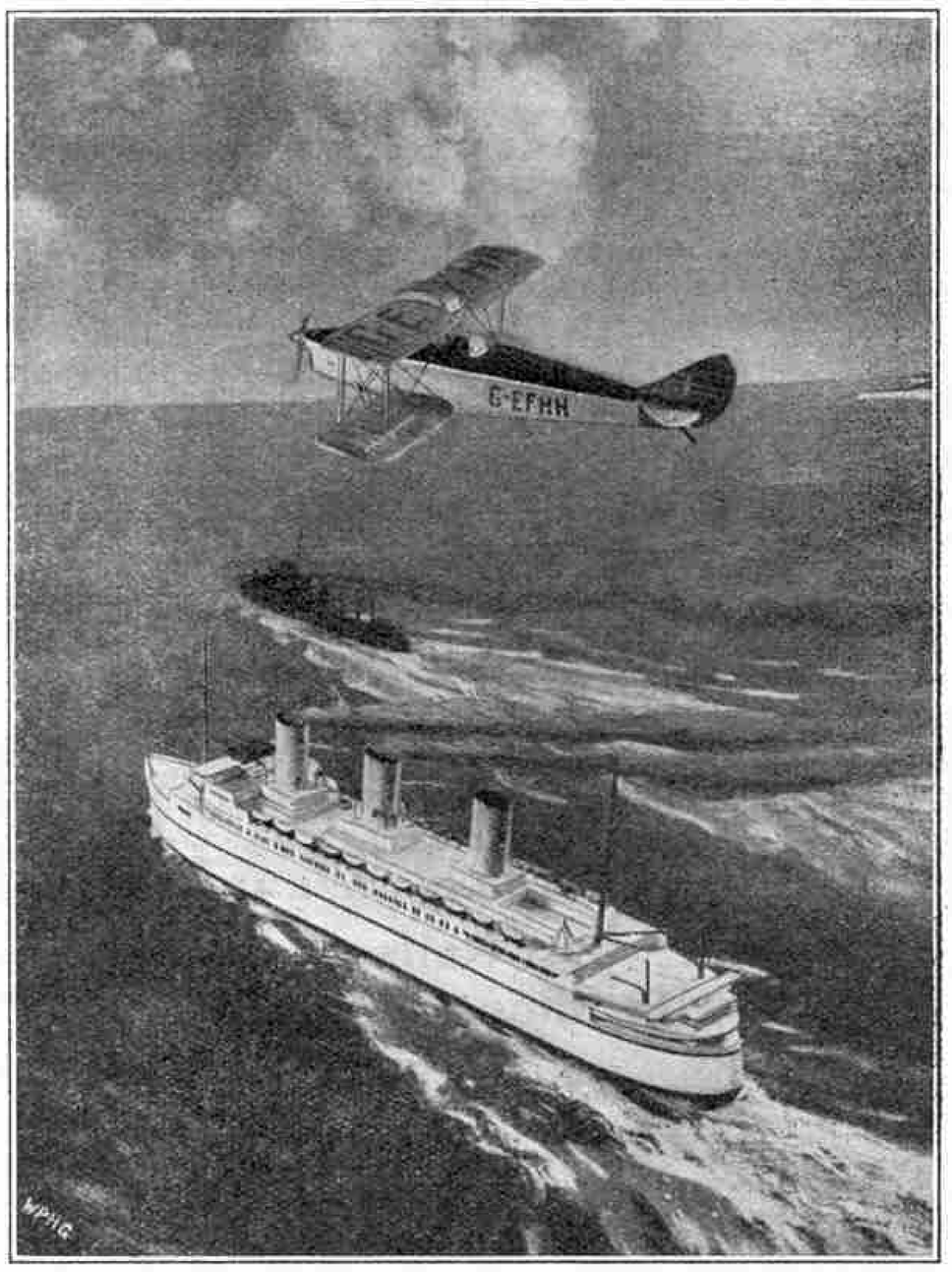

Photograph of a D.H. GIPSY III Moth flying over the R.M.S. "EMPRESS OF BRITAIN" and the Destroyer H.M.S. "BRUCE." The Aeroplane was constructed from No. 18 SKYBIRDS set, price 2/–, and the Ships from No. 7 and No. 5 SHIPSERIES sets, price 4/6 and 2/– respectively. The Aeroplane is to a scale of 1/72nd and the Ships to a scale of 100′ = 1″.

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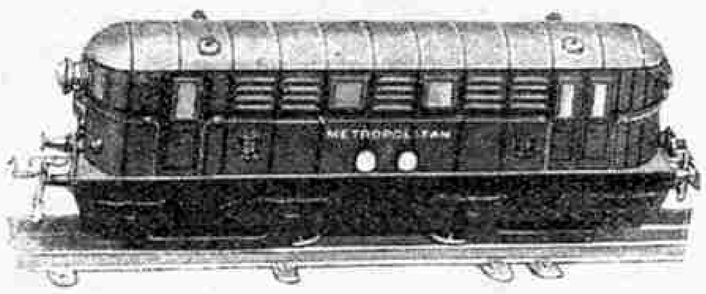

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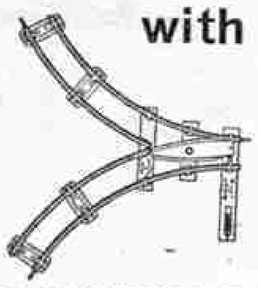

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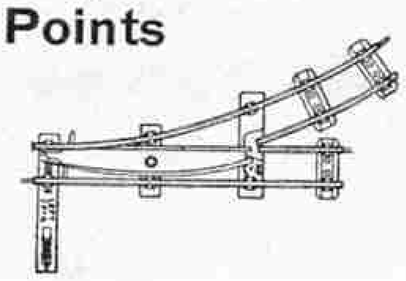

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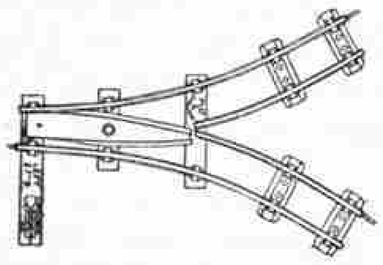

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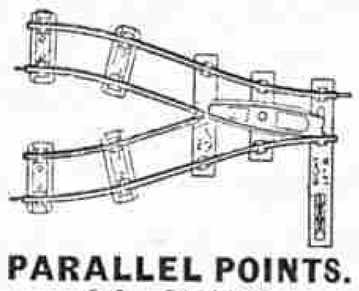

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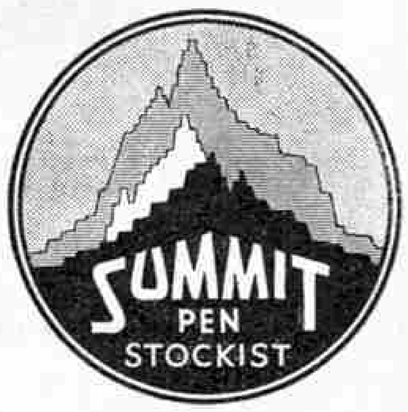

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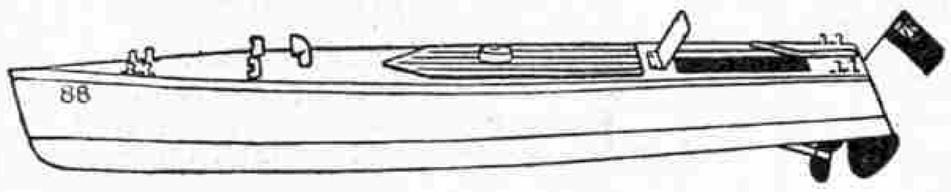

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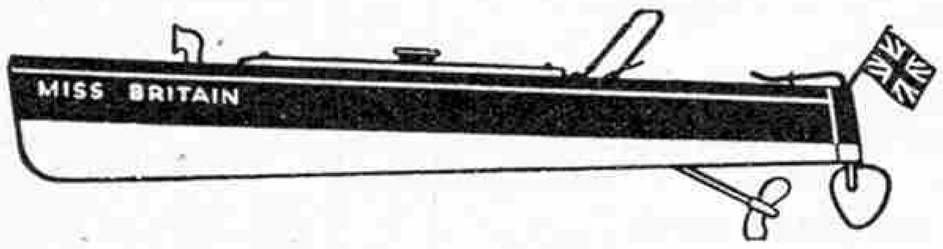

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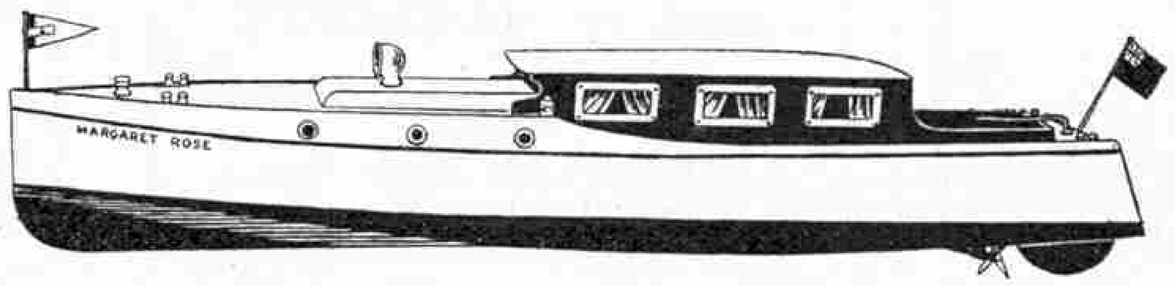

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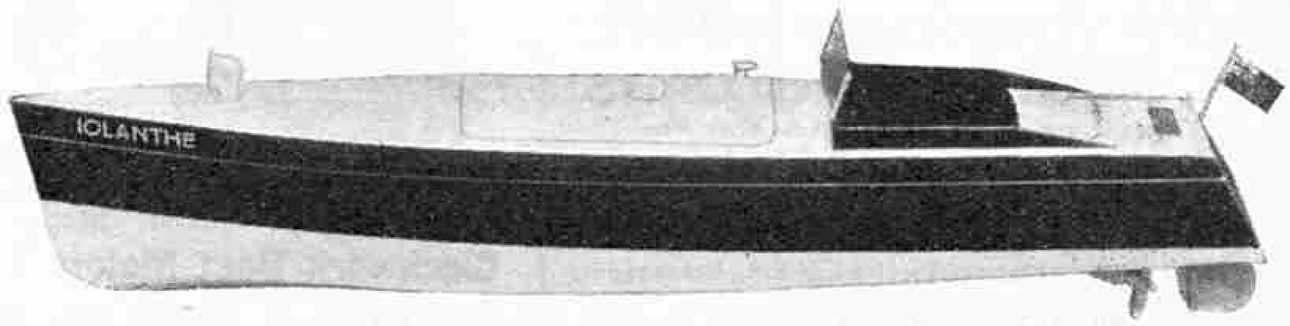

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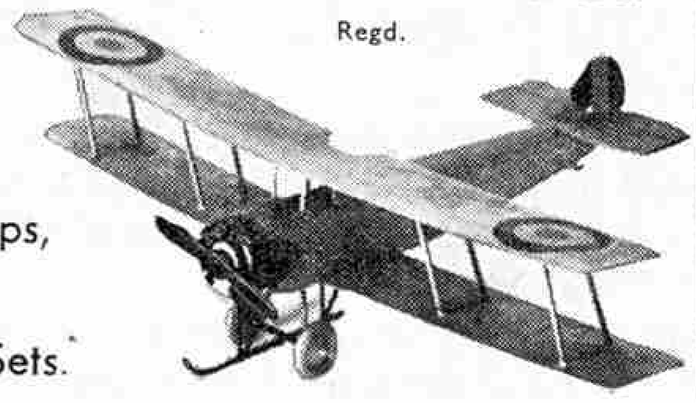

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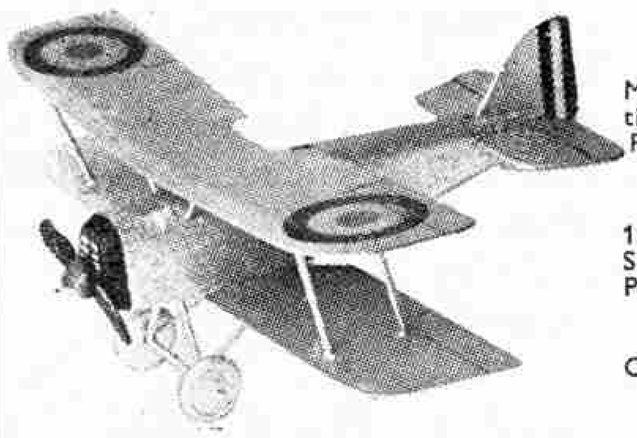

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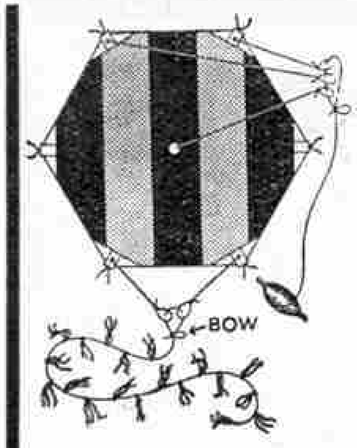

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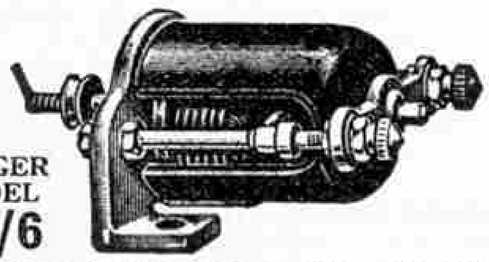

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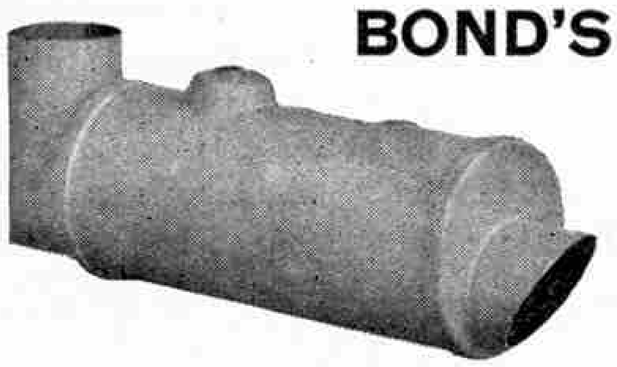

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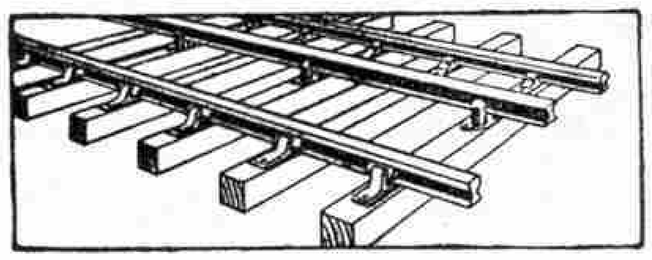

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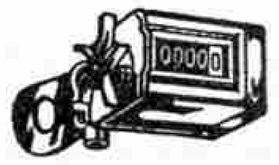

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Meccano Exhibition in Wallasey

The Annual Conversazione of Wallasey Grammar School was held on 10th February, and as usual a Meccano Model-building Contest formed a popular part of the proceedings. The models shown were more numerous than in previous years, and competitors displayed great originality and ingenuity in the design and construction of their entries. The first prize was awarded to K. Hughes, who showed a Mechanical Lift Bridge over which ran the lines of a Hornby Train layout. Second and third prizes were won by R. S. Harwood and F. S. Miles, who exhibited a Grandfather Clock and a Rocking Battleship respectively. The interest of the Conversazione was greatly increased by an Exhibition of working models, including a Workshop and a Travelling Gantry Crane, loaned by Meccano Limited.

For South East London Readers

Readers of the "*M.M.*" in Lewisham, Catford and district will be interested in a splendid working Meccano model of the chassis of a Morris-Cowley motor car that is being exhibited in the windows of local dealers. The model has been built for instructional purposes at the Kent School of Motoring, 15, London Road, Bromley. It is complete in every detail and ingenious use is made of a sloping mirror beneath the chassis to reveal the manner in which the clutch, brakes and gear box are operated.

The model has already been displayed by Meccano dealers in Bromley and district and will be exhibited from 1st April to 14th April by Messrs. Chiesmans, High Street, Lewisham, S.E.13. From 15th April to 30th April it will be shown by Messrs. Preston and Bennett, 225, Bromley Road, Catford, S.E.13, and will then remain until 14th May at the premises of Mr. F. C. Cabeldu, 371, High Street, Lewisham, S.E.13.

A Surbiton Hobbies Exhibition

The Second Annual Hobbies Exhibition of the Tolworth Central (Boys) School, Surbiton, was held on 2nd and 3rd March, and was attended by a large number of visitors, who were greatly attracted by the display in the Meccano Model-building section. Among the models on view were a Motor Chassis, a Revolving Searchlight, a Pontoon Crane and many other well-constructed working models of original design. A model of Watt's Beam Engine, loaned by Meccano Ltd., added to the attractions of the section. Excellent use was made also of Meccano Aeroplane Constructor Parts, which were employed in the construction of a series of models of various types of aircraft.

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To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

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Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/- for six months and 16/- for 12 months (post free); Canada, where the price is 10c. per copy, and the subscription rates 65c. for six months, and $1.25 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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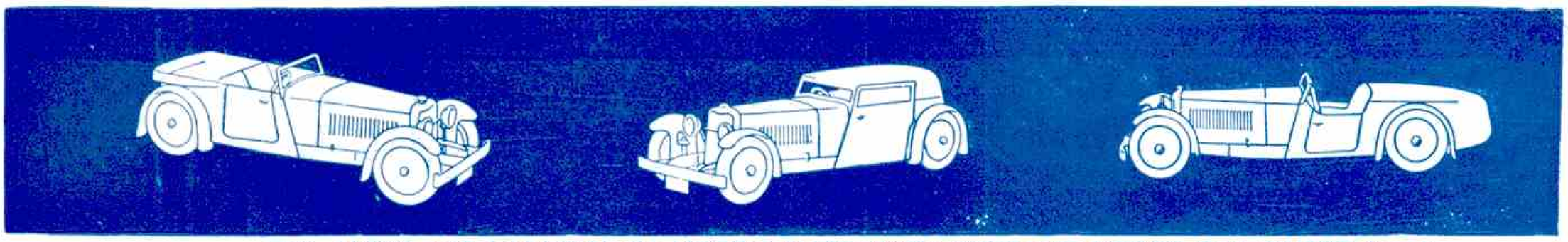

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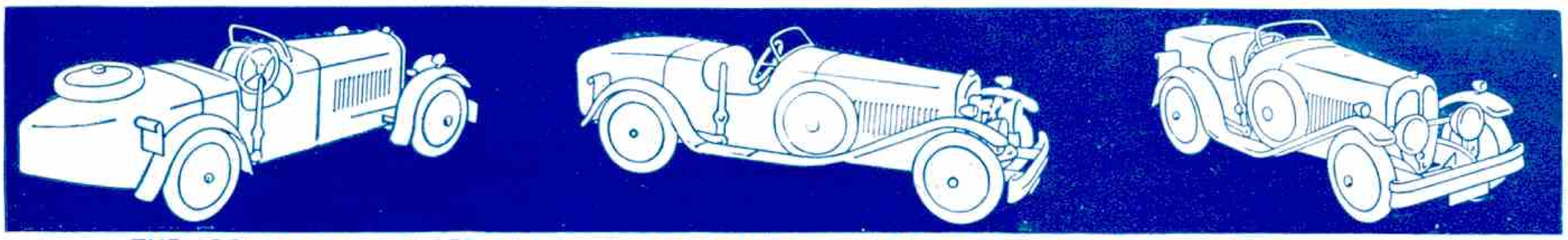

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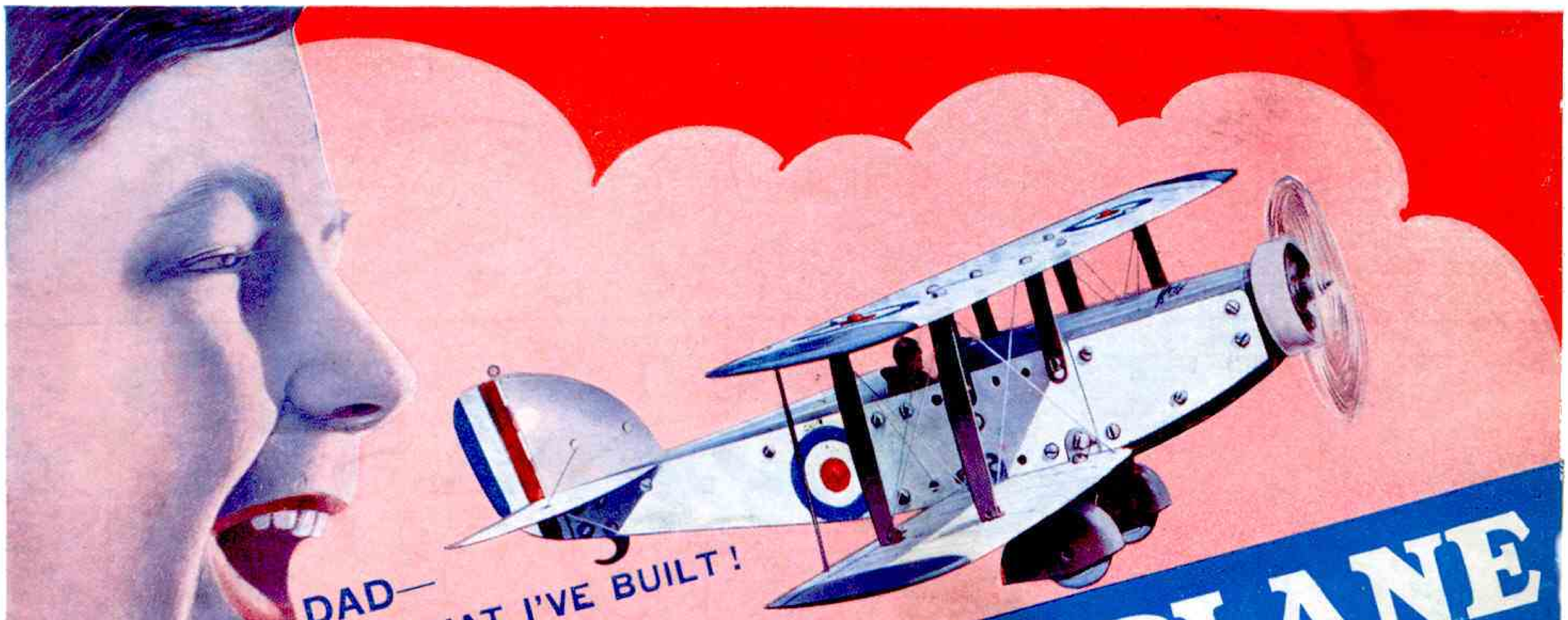

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The parts in this super Aeroplane Outfit will build over 20 realistic models of different types of aircraft. The range of special parts includes main planes fitted with ailerons, tail planes with elevators, movable rudder, radial engine cowling, etc. Price 15/-

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MECCANO LTD. - BINNS ROAD - LIVERPOOL 13

No. O Aeroplane Outfit

No. 1 Special Aeroplane Outfit

No. 2 Special Aeroplane Outfit

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